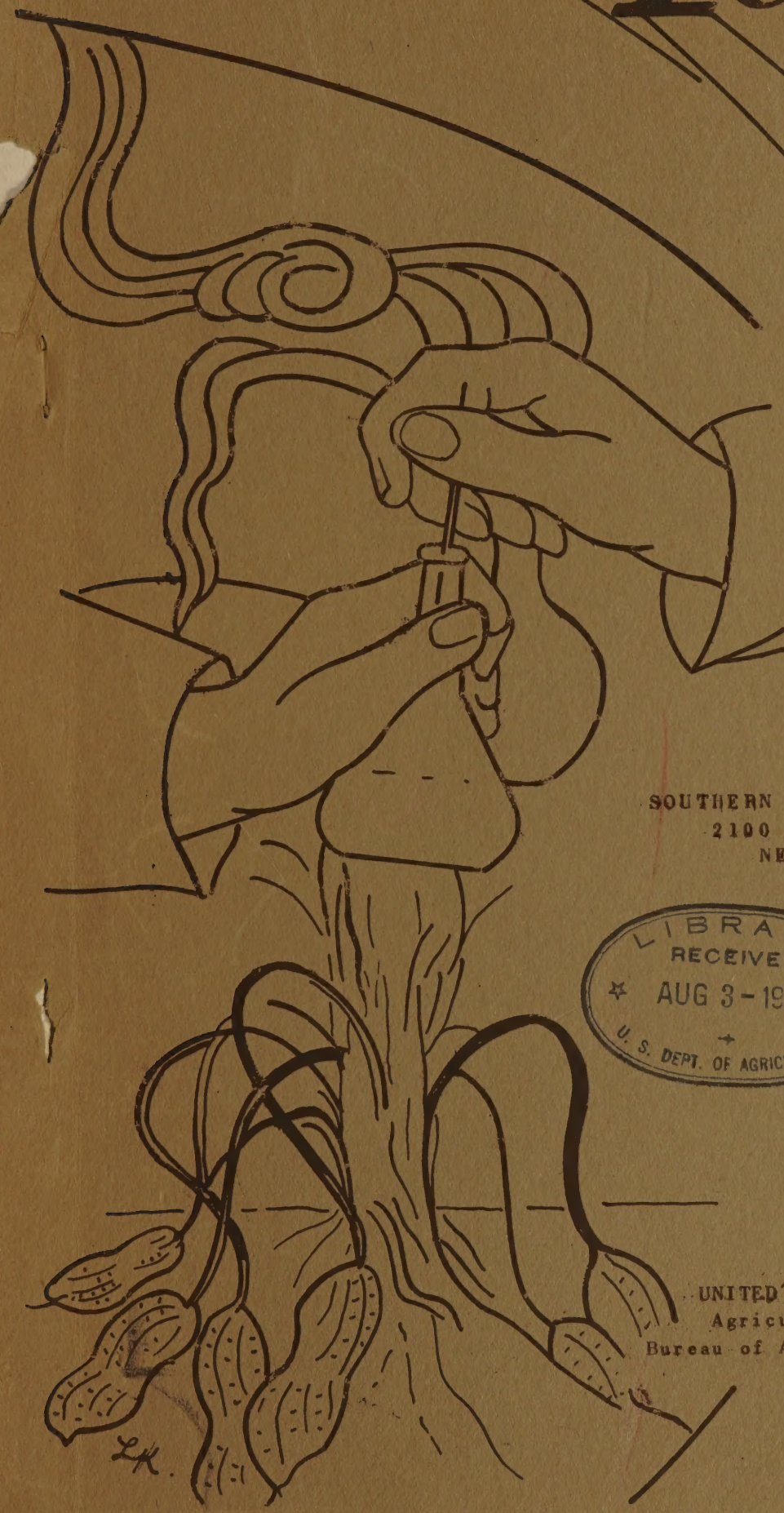
Peanut...



RESEARCH CONFERENCE

ON UTILIZATION OF

EDIBLE PEANUTS

February 5 - 6, 1953

at the

SOUTHERN REGIONAL RESEARCH LABORATORY
2100 ROBERT E. LEE BOULEVARD
NEW ORLEANS, LOUISIANA

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Agricultural and Industrial Chemistry

F O R E W O R D

The information summarized in these proceedings was presented at the Research Conference on Utilization of Edible Peanuts held at the Southern Regional Research Laboratory, February 5-6, 1953.

This Research Conference was a working conference sponsored by the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, and was held in cooperation with the peanut industry and other federal and state agencies which conduct research on peanuts.

Staff members of the U. S. Department of Agriculture reviewed research on peanuts and peanut products with particular emphasis on the relation and application of research results to problems in utilization of peanuts for edible purposes. Speakers from the peanut industry were particularly concerned with research which could be conducted to improve the quality of edible-grade peanuts and salted-peanut products.

The statements contained in the speeches reproduced in these proceedings of the conference are those of the speakers, and do not necessarily indicate or reflect the views and beliefs of the U. S. Department of Agriculture.

C O N T E N T S

A P P E N D I X

ADDRESS OF WELCOME

by

C. H. Fisher, Director
Southern Regional Research Laboratory
Bureau of Agricultural and Industrial Chemistry
Agricultural Research Administration
U. S. Department of Agriculture
New Orleans, Louisiana

Mr. Chairman: Members of the Conference.

I am very happy to have the privilege of representing this Laboratory and our Bureau in welcoming you to the Southern Laboratory and the Conference on peanut research.

You have travelled many miles to attend this conference as representatives of the peanut industry and other organizations doing research to improve the position of peanuts. We hope that your visit will be both pleasant and profitable and that you'll have the feeling on leaving that the Conference was highly successful.

It is interesting to note that this is National Peanut Week. For this reason it is most appropriate that a research conference on utilization of peanuts is being held during this week. Although the National Peanut Council is undoubtedly conducting considerable publicity in connection with peanuts this week, this conference may well be the most important event, research-wise, this week for the peanut industry.

Because many of you represent industry, I should like to take a few minutes to point out that the cooperation of industry has contributed greatly to the success of our research program. We profit from the cooperation of research during all stages of our work. For example, we work with industrial and other appropriate organizations in planning our research and in selecting the most important and promising research projects. This conference illustrates one way in which we obtain valuable information and suggestions on the important problems involved in processing and utilizing an agricultural commodity.

We consult frequently with various other organizations in doing our research, and we take the results of our research to industry and obtain cooperation in putting our research to work for the good of the farmer and other citizens.

Industrial organizations have been very helpful and cooperative, and we appreciate their important contributions to the success of our program.

For most of the commodities studied in this Laboratory, there are informal groups or committees that bring information to us about the need for work and examine our program from time to time for the purpose of offering helpful suggestions. For example, the Cotton Utilization Panel and Collaborators from the National Cotton Council work with us in developing a realistic program of research on cotton. The groups listed below also work with us in connection with our program:

Technical Committee of the National Cottonseed Processor's Assn.
Oilseed Collaborators (oilseeds in general).
Industrial Committee, American Sugarcane League.

Other committees and collaborators cooperate similarly in connection with our work on rice, citrus fruits and pine gum.

The research achievements of the Bureau of Agricultural and Industrial Chemistry that have been brought into being with the cooperation of various other organizations and with the aid of research committees and collaborators include:

Penicillin (Northern Regional Laboratory)
Frozen orange concentrates (U.S. Citrus Products Station, Winter Haven, Florida)
Improved cotton bandage (Southern Regional Laboratory)
Improved synthetic rubber emulsifiers (Eastern Regional Laboratory)
Advances in the processing of fruits and vegetables (Western Regional Laboratory)
New machinery and techniques for processing cotton (Southern Regional Laboratory)
Pasteurized pickles (U.S. Food Fermentation Laboratory, Raleigh, North Carolina)
Improved quality and yield of turpentine and rosin (Naval Stores Research Station, Olustee, Florida)

The products and processes made available by these achievements have not only enriched our way of living but they also have added the equivalent of many millions of dollars to our economy.

We hope that, during your stay in New Orleans, you will be able to visit our individual laboratories and to discuss research with many members of our staff. Please let us know of anything we can do to make your visit to New Orleans more profitable and enjoyable. We wish to thank you for coming to New Orleans to participate in the peanut conference -- a meeting that I am confident will prove generally successful and beneficial.

SOME THOUGHTS CONCERNING BASIC RESEARCH ON PEANUTS 1/

George W. Irving, Jr., Assistant Chief,
Bureau of Agricultural and Industrial Chemistry
Agricultural Research Administration
United States Department of Agriculture
Washington, D. C.

As most of you know there is a feeling among many concerned with agricultural research, that fundamental or basic research is being neglected more than it should be and that greater emphasis in this field is needed. This attitude for increased emphasis on basic research is reflected in several recent events.

One is a general recommendation issuing from the deliberations of the Chairmen of Commodity Advisory Committees and from those of individual advisory committees which meet each year to review progress of current research and to suggest new work in the Department of Agriculture. One of these committees - the Oilseeds and Peanut Advisory Committee - is concerned with matters to be discussed at this Conference. This Committee recommended in their cost report that "greater emphasis be given to long-term fundamental research."

The importance of basic research is forceably brought to our attention by a recent press release which announced that the National Science Foundation is promoting fundamental studies into how sunlight may be used to create new food sources and industrial power. The immediate support and effort on basic research concerns a program on photosynthesis, the mechanism by which plants convert sunlight into chemical energy.

Fundamental research, particularly that dealing with the chemical composition of crops and other plants, was also stressed recently by Dr. Hilbert, Chief of our Bureau of Agricultural and Industrial Chemistry. His talk, given at the December Meeting of the American Association for the Advancement of Science, was on "Opportunities for Chemistry in Agriculture." Dr. Hilbert pointed out that lack of basic organic chemical knowledge of many individual plant constituents is due to the fact that until recently the tools and methods available for obtaining precise information on chemical composition were clumsy and crude. Today, he stated, the newer tools of chromatography, ion-exchange techniques, molecular distillation, differential solvent extraction, radioactive tracers, and infra-red spectrophotometry - to mention a few - have completely altered the situation. We are now in a better position than ever before to secure through basic research a more complete knowledge of the composition of agricultural commodities which is so essential to the successful solution of the many important problems facing agriculture.

1/ Presented before the "Research Conference on Utilization of Edible Peanuts" held at the Southern Regional Research Laboratory, New Orleans, Louisiana, February 5-6, 1953.

It may be of interest to learn that a recent survey of the Bureau's present research indicates that approximately 16 percent of the total funds available are devoted to basic research. The Bureau, incidentally, has about 375 individual research projects and an annual appropriation of 7 1/2 million dollars. This percentage figure for the proportion of basic research in our entire research organization, need not necessarily serve as a guide in the formulation of a research program on peanuts. Some will feel that the figure should be closer to 25 percent or even as high as 50 percent.

We realize it is often difficult for members of an industry to appreciate fully how research of a purely basic character can benefit that industry. Nevertheless, it is true that, many of the things we are now doing with peanuts are based in one way or another on fundamental knowledge resulting from past work, incomplete as it may have been. Such work may even have been conducted on other commodities, illustrating that the general principles and results ascertained often extend far beyond the particular crop or product actually studied. Thus some of the basic research on proteins and glycerides of cotton-seed and soybeans, for example, apply with equal force to similar counterparts occurring in peanuts.

A striking illustration of the effect that basic research may have on the development of a product is to be found in the case of glucose-free dried egg. This product, which was developed more or less by accident, serves to show how fundamental research sometimes pays dividends sooner than expected and very often in unexpected directions. Basic research at the Western Regional Research Laboratory directed primarily to egg constituents such as proteins, fats and carbohydrates led to the experimental need for a sugar-free whole egg. In obtaining this material free of glucose by means of yeast fermentation it was soon observed that the dried product possessed improved keeping quality. Further research resulted in a product markedly superior in quality which is at least 10 times as stable as plain spray-dried whole egg powder. The improved product is important in military procurement as well as in the commercial production of products requiring stable dried eggs. This is an exarple of how basic research pointed the way to the practical conversion of a perishable food item into a more stable form for use in prepared cake and other increasingly popular mixes. So much interest has been manifested that a mushrooming demand for the product promises to result in the placing of egg-containing pre-mix products in the pantry of almost every household in America before very long.

In reference to the immediate problems before the present Conference it seems logical that this group should discuss and seriously weigh a program of basic research which will yield data not only useful in connection with long-range problems but in the solution of some of the more practical problems now facing the peanfut industry. Consideration should be given to the need for fundamental research directed primarily toward better quality and increased nutritional value of raw peanuts and peanut products, with further secondary thought accorded basic problems relating to peanut oil and meal.

This means, in effect, that consideration should be given to increasing the attention to be paid to the chemical composition of peanuts, to the properties and reactions of individual constituents, and the effect on such substances of varietal differences, cultural practices and other factors including treatments received after harvesting such as curing, storing, blanching, and roasting, all of which may involve moisture, temperature, enzyme or microbiological relations. In these studies particular attention would be devoted to glycerides and fatty acids, proteins and amino acids, and to minor constituents such as sterols, vitamins, natural antioxidants, enzymes, flavor substances, tannins, and coloring matters. The latter substances are minor in quantity only since they can influence very greatly the ultimate usefulness of peanuts and products derived from them. It goes without saying that much of this type of work should, at some stage or other, be jointly planned with other groups and be conducted as a cooperative effort involving the different technical disciplines in other agencies of the Federal Government, the Experiment Stations and industry.

While the production of oil, meal and cake represents the marginal part of the peanut industry, nevertheless a sizable amount of peanut oil is produced annually and therefore problems in this field cannot be neglected.

In addition to the problems mentioned, which are merely by way of example, there are other problems concerning peanuts, the solution of which requires basic information. It is impossible to predict in advance how basic research on any particular problem will result immediately in increased sales or profits to the industry. Long-term fundamental research will, however, ultimately pay dividends to the peanut industry as a whole just as intensive efforts in this direction have aided and will continue to aid other industries.

There is confidence, therefore, that this Conference, composed as it is of individuals who are thoroughly familiar with every segment of the peanut industry, affords a real opportunity to recommend a sound, broad program of peanut research. By sound program is meant one which will be well balanced with respect to both basic and applied research. Such a program when finally approved must, of course, take into consideration limits of available funds, personnel and facilities, but nevertheless it should and can be of such a character that substantial contributions will be made toward the solution of problems important to the peanut industry.

Research on Production of Peanuts for Food

by

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Purpose of this review

Why do we start this Research Conference on Utilization of Edible Peanuts with a paper on production research? Because many of the problems encountered by processors and end-users are raw stock problems. From both the economic and the technological standpoints many of the things that can or cannot be done satisfactorily with peanuts after they leave the farm are determined before they leave it. This is, of course, true for all food crops. The producer, dealer, shipper, processor, and consumer are all affected by what happens to the peanut from preparations for planting clear on through the chain of events including finally the eating of the product.

Probably no other crop of such acreage, production, and value in this country is less well understood than the peanut. As an object of research it has been so badly neglected that even now it receives far less attention than some other crops having considerably less economic importance. Problems seem to be increasing faster than solutions for them, and a lot of people are unhappy about these problems. Peanut production technology is not keeping up with the parade.

Often, when we are asked to discuss current research in a particular field, we feel that we must oblige our audience with the brightest picture we can reasonably present. Everyone enjoys a success story; and a little gentle boasting about all that we are doing is perhaps expected. On some other occasions we are inclined to moan that the world is going to pot because our particular researches are not supported in the manner to which we would like to become accustomed. I hope I can avoid both extremes here, and give you a reasonably balanced view. The production-research picture is by no means all dark, but there are parts of it that need a lot of brightening up.

Without attempting to summarize findings and developments, I want to give a general view of what kinds of research are being done on peanut production in this country, where, and a rough indication of its scale or magnitude. An effort is made to show which problems, of the multitude that plague producers, are receiving most attention and which ones little or none.

The problems being worked upon are each important in one or more places but they are not of equal significance or importance to the industry as a whole. Unfortunately, some of the most needed studies having the greatest potentialities for long-time general benefit are the most neglected. The reason, of course, is the terrific popular pressure for quick results from the kind of

of work that promises to turn an immediate profit. The research program of any agency must be a compromise between what it considers ideal and what is most feasible with the resources it has in sight. Actual emergencies arise to divert resources from long-time objectives to efforts for quick relief. No agency can ignore popular clamor for some quick results. On the other hand, no group of farm or industry leaders can afford to be so short-sighted as to force their research agencies into a program that minimizes or ignores long-time fundamental work on the really big problems.

From this review I believe you will see that too little fundamental work is being done on the peanut plant and its management. Most of us in peanut production research have been under such pressure to get immediately practical results quickly that we have not gone sufficiently into the nature of things and the reasons why. Those agencies that have been able to devote a substantial share of their resources to basic work are to be commended. They will render the greatest service in the long run.

How to study this review

I will point out later many lines or kinds of work that are being done at several places simultaneously. In only the rarest instances, however, is any real "duplication" involved, if any. It is clear that all "applied research" involving responses to local soils, climate, and localized or regionalized situations must be conducted in many different places. A variety, fertilizer practice, or management practice that is best in one place is not necessarily best in another. This is also true for many pest control measures, harvesting practices and other elements in crop production. Although two or more groups are working upon apparently identical problems, that is not necessarily wasteful. The problems may be really different because the situations are different. Even if the situations are the same, some replication is necessary. No modern research man would fail to repeat or replicate his experimental procedures. It is valuable to have work done in one place checked by similar work in another. Furthermore, independent projects directed to the same objective by two or more agencies will not be conducted in the same way. Different men with different ideas and conditions of work will be involved. Where one might fail, another will succeed. The oft-repeated complaint about "duplication" of activities has little or no justification in regard to crop production research. Research men do not usually enjoy doing exactly what another is doing, except to verify (or deny) some important claim. Even outright competition is a spur to achievement, although in research it is generally looked upon with disfavor.

Many project titles are so broad as to permit different lines of work being done although the titles have similar words in them. What may appear superficially as duplication may involve no duplication whatever.

Project statements (or even outlines) alone rarely indicate what resources are devoted to a particular piece of work. Some very impressive plans may be accompanied by such limited money and manpower that only a fraction of work planned can possibly be done adequately. There are no efforts to

deceive in such cases. Paper work is saved and desirable flexibility is afforded by establishing projects in fairly broad terms. Agencies differ widely, however, in the degree to which they are specific or general in their project statements. It will appear here that nearly all important fields of inquiry are receiving some attention, but it should be remembered that few men in any one agency are concerned with peanuts, and those who are usually have to work on several other crops.

Our State and Federal research agencies are doing their best to cover the field, but the resources are spread generally much too thinly. Most men in this field are trying to run too many different projects which of course tends to reduce the chances of best success with a great many of them. Too often, in our efforts to serve more and more people we only succeed in serving each group less and less as more tasks are taken on.

Work in Progress

Few in this audience are interested in the organization of research within agencies or among agencies in different political subdivisions of the country. You are mainly interested in production problems as they touch your own phase of the business in one way or another. I am, therefore, going to focus main attention on groups of problems with only incidental information on who is doing the work. My information on these activities has been taken from recent reports of the agricultural experiment stations, USDA files of State and Federal projects, and from my own associations with State and Federal research men. No claim for completeness is made. Many interesting and valuable studies are made before records concerning them are brought entirely up-to-date. This review, however, should afford a general picture.

Variety testing

There is no more perennially interesting subject to growers and users alike than how to get more productive varieties of high quality and resistance to disease. Every State with an important acreage of peanuts is conducting variety tests. All of these but one are cooperating with the USDA in running regional trials of identical lists of varieties and advanced breeding lines produced by various agencies, both here and abroad. Samples from all plots are sent to Beltsville for determinations of moisture, shelling percentage, and size distribution and for observations on quality. The laboratory results are reported to all cooperators annually. These tests have always included locally grown sorts for comparison and they have all shown locally grown stocks to be inferior to the best test stocks. On the whole our commercial peanut seed stock situation is deplorable.

Breeding

Five States and the USDA independently or in cooperation with some of the others, are doing active breeding and selection to get improved varieties. Until recently this improvement work consisted only of selection within

varieties or selection within progenies of inter-varietal crosses of the common species of peanut. The Florida, Georgia and Virginia Stations and the USDA perhaps have projects that have been most active for the longest time and they have recently introduced three new varieties: Dixie Runner by Florida, Dixie Spanish by Georgia, and the USDA and Virginia Bunch 46-2 by Virginia and the USDA. In North Carolina a large program is in progress from which valuable contributions can be expected and there is also a less extensive one in Texas.

Recently attention has turned to possibilities of inter-species crosses for obtaining varietal improvement, but it is too early to tell how much those efforts will be worth. Only minor attention has been given to the genetics and cytology of the peanut, as compared with many other crops and with other work done on peanuts. Georgia, Florida and North Carolina have probably done the most in this field.

In breeding work now, increasing attention is given to relative resistance to specific diseases or disease complexes. Parents are sought that show resistance to or freedom from leaf spots, concealed damage, and peg and root rots. Varieties and introductions observed so far have shown no startling disease resistance, but that is no proof that such resistance can't be found anywhere. This search should be expanded and intensified. The odds for success are pretty low: That means that an enormous amount of good work will have to be done.

In evaluating breeding lines now, the job is not finished when the yield and grade data and shelling percentages are determined. Most breeders run promising lines through a small processing laboratory to be sure that they will produce salted peanuts or peanut butter of satisfactory quality.

Seed maintenance

I'd like to digress for just a moment here to remind you of a situation that is one of the most serious drawbacks to the entire peanut industry. It is not a research problem, however. It is a service problem or business problem. This is it: There is no seed business in peanuts in the sense that there is with seed corn, vegetable seeds and most other crops seeds. More than one good new peanut variety has been virtually lost soon after its release because neither growers nor anyone else in the industry would keep it pure and propagate it for seed purposes.

What is the point of our research men producing a good new variety if through carelessness and indifference it is allowed to disappear in a few years? Public research agencies should not go into the peanut seed business -- that should be done by private enterprise, as with seeds of other crops. Unless a lot more is done to keep varieities pure than has been done in the past there really isn't much point in a breeding program. There are recent signs of improvement but they aren't nearly extensive enough. If you men of industry want the best raw stock, and want it produced on a dependable basis

by growers who get the most out of their efforts, see what you can do about improving seed supplies. Research and extension men can show you how, but business must do the job. The job must be done if the industry is to prosper.

Fertilizers and soil management

Next to variety testing, fertilizer and soil amendment studies are most generally conducted by State experiment stations. All but one peanut State lists peanut fertilizer studies, and that one doubtless does some work with peanuts as part of its fertilizer research program.

The results of peanut fertilizer and lime research include excellent examples of what often happens when we try to solve a deceptive, practical problem without good basic knowledge of the plant we are dealing with. For many years many stations accumulated a most conflicting and baffling mass of data on peanut responses to lime and various fertilizers. There seemed to be no rhyme or reason to much of it until basic work was done about a dozen years ago on the mineral intake by pods as well as by roots of different types of peanuts and on the different soils on which peanuts are grown. Now we can conduct fertilizer and soil amendment experiments that will have more meaning for us. Still, however, the nutrition of the peanut plant is not nearly so well understood as that of many other crops. It is still difficult to make sound recommendations on fertilizers and soil management.

Work on deficiencies of minor elements in the soil and in the peanut plant is being done in Florida, North Carolina, Oklahoma and Virginia. Minor element deficiencies are more likely to occur in peanuts than in some other crops because we customarily grow them on only the lighter soils, even sandy ones, where deficiencies are more likely to occur.

Most growers and investigators are aware of the need for crop rotation or at least a diversified sequence of crops on any particular field. Little is known, however, about the relative value of specific rotations that include peanuts, or the relative values of crops to precede or to follow peanuts. We think we know some general principles but can claim little exact knowledge. Experiments on rotations and crop sequences are difficult, expensive, time-consuming and often not very conclusive even after several years' work. We can understand the reluctance of workers to spend a big share of their resources on rotation experiments. Four States, Alabama, North Carolina, Oklahoma and Virginia currently list such studies.

As the peanut is customarily grown, although it is a legume, it is a soil-exhausting crop because the entire tops and some of the underground parts are removed from the land at harvest. Soil improving crops are now understood to be essential in a cropping system that includes peanuts. Generally soil improving crops or green manure crops are included in any rotation or crop sequence study. Such work is listed by Alabama, North Carolina, and Oklahoma and is probably in progress at other stations.

Harvesting and curing

High costs of manpower and its stortage at any price have put real urgency behind the need to increase mechanization of peanut production. This is especially true of the harvesting of the crop and its handling incidental to proper curing and picking. Harvesting and handling through picking account for a large share of the total production costs. Alabama, Georgia, North Carolina, Virginia and the USDA all have formal projects on these proglems.

Harvesting and curing studies involve two main lines of effort that are distinct but that must be carefully dove-tailed for best results: (1) Engineering work on machinery, equipment and structures and (2) physiological work on how the peanut behaves when handled in different ways. Thus far it appears that the biological problems are going to be even more difficult to get around than the mechanical ones. Machines that will "conbine" peanuts either directly from the soil while they are very high in water content or from windrows after any desired degree of drying has occurred have been built. Equipment and structures that will dry the picked nuts in a reasonable time have also been devised. Trouble is encountered, however, in using these mechanized methods in a way that will produce a finally dried peanut that has the desired flavor, texture, and seed value such as can be produced by good old-fashioned stacking. Too much weather damage may occur in windrows. Too rapid drying or too high drying temperatures may impair flavor, cause the seeds to be too easily skinned and broken in shelling, or lower the value of the seed for planting purposes.

At present, these harvesting and curing problems are extremely pressing. Growers are facing somewhat of an emergency. Because they are too often unable to stack the harvested plants carefully by hand, or even in any fashion, many poor quality peanuts are getting into the trade. Some of this poor quality is being blamed on the use of agricultural chemicals. Although improper use of certain chemicals is known to impair the eating quality of peanuts, there are several other ways to spoil them. We have to remember that poor quality was a problem long before BHC, for example, was ever made. And even when we find procedures that give good quality they will have to be economical if they are to be practical.

Both our engineering and crop groups in the field and at Beltsville have been cooperating closely with a number of States in harvesting and curing investigations but we would all like to do more.

Diseases and insects

About a dozen years ago treatment of peanut seed with fungicides to improve stands became a virtually universal practice almost overnight. It has proved to be a simple, inexpensive, effective, and highly profitable procedure. Indeed, with machine-shelled seed it is essential. To a much smaller extent, dusting became common for the control of leaf spot diseases and leaf-hoppers. Little work is being done on those problems now except to try out new chemicals as they come along to see whether they have any advantage

over those now used. Other diseases, however, are still largely uncontrolled and a lot of work needs to be done. Among these are southern root rot, various post-emergence seedling disorders, and "concealed damage". The soil borne diseases are probably most serious but they are not being worked upon in a big enough way to make us optimistic about controlling them soon.

The North Carolina station has an excellently planned broad study of soil-borne diseases on peanuts. The Georgia Station at Experiment is giving special attention to factors affecting diseases that attack young plants after emergence. Alabama is working on dusting to control leaf spots. Alabama, Georgia, Virginia and doubtless others continue some work on seed treatment. Nowhere, however, is any one agency or group of agencies making the kind of large scale concerted attack on soil-borne diseases that is required to make rapid progress. Southern root rot is gradually becoming worse and no agency has the resources to "go after it" as the job should be done. It will be a long, slow, expensive, unspectacular kind of a job. It will involve extensive study of fundamentals, the kind of "long-haired" scientific inquiry that we all agree needs doing but for which no one seems enthusiastic about paying.

Nematodes are another highly important group of pests about which far too little is being done. The North Carolina Station and the USDA have projects in this field but they are small ones. Work in this field needs to be greatly expanded. Because of the very small number of trained nematologists in this country many more men will have to be trained before any great expansion will be possible.

The Bureau of Entomology and Plant Quarantine of the USDA has perhaps the most active program of research on insects that attack peanuts, with special attention to southern corn rootworm and to thrips. Work is also done on corn earworm, fall army worm and velvet bean caterpillar. Virginia has work on southern corn rootworm in cooperation with the USDA and North Carolina and Alabama are also working on this problem. An important phase of studies on control of soil-inhabiting insects is determining the effects of insecticides in the soil upon the quality of the peanuts. Insecticides are known, for example, which give good yields of beautiful-appearing, insect-free peanut pods but which impair the flavor and odor of the peanuts. The problem is to find control measures that have no undersirable effects. The USDA is cooperating with both Virginia and North Carolina in studies of effects of various insecticides on quality. Work has also been done in Georgia and South Carolina on this subject.

Physiology and anatomy

Basic work on the structure and behavior of the peanut plant appears to be rather sadly neglected. Only three States, Florida, Virginia and North Carolina appear to have active projects on nutrient requirements, effects of specific elements on flower and fruit formation, the biochemical processes during growth and development, the anatomy of the plant and related fundamental questions. And the men who are doing such work with peanuts have much other work to do.

Virginia is studying the effects of variety and location upon quality and such components as protein, oil, and vitamins and also the effects of time of planting and of harvest upon fruit development from pegs that arise at different specific times during the season. North Carolina is continuing studies, among others listed above, on the uptake of minerals by roots and pods separately and the interactions between them. Radio-active tracers are being used. Florida is studying the nutrient requirements of pegs and fruits in different soils.

Conclusion

I think we have to recognize the inadequacy of our country's research on the peanut without finding too much fault with the research agencies. We can all see holes and weaknesses in our respective programs. In my own Division, for example, a pathologist is not assigned to work on peanuts even part time, despite the increasing severity of losses. And pathologists elsewhere who are working on peanut problems usually can give only part time to them. Soil-borne diseases just won't be conquered on this scale of work.

I believe the ice has been broken on fertilizer and soil amendment problems; some real progress and understanding are coming about. We still have a long way to go, however, on how to mechanize the crop without serious loss of quality.

Some real headway is being made in practical breeding, but it is being made the hard way and too slowly because we don't know enough about the peanuts and related species of the world, their respective breeding behaviors, their inter-breeding possibilities, what properties they possess, and how they are inherited. Some fundamental work has been done and some is in progress but not enough. And we still don't have a peanut seed industry.

The results obtained and the work now in progress look rather good when we take into account the resources that have been and are now available for peanut research. For too long, however, peanuts have been considered "just peanuts." There is still too little appreciation of the magnitude of their production and the problems faced by producers. Soil-borne disease problems and quality problems attending current harvesting and curing difficulties are perhaps most urgently needing increased attention.

Research at the Southern Regional Research Laboratory On Utilization of Edible Peanuts

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Introduction

The purpose of this conference is to review problems confronting the peanut industry and to select lines of research that offer the best possibility for improving the utilization of peanuts for edible purposes. The purpose of this talk is to summarize results of research at the Southern Regional Research Laboratory on improvement of quality of peanut butter. At the same time these remarks may illustrate how our research projects may be initiated, organized and conducted.

The research on peanut butter conducted at the Southern Regional Research Laboratory had its origin in recommendations made by the Peanut Advisory Committee in June, 1947 for high priority for research on improving the quality of edible peanut products, including peanut butter. In its meeting in January, 1948 this committee reviewed research investigations proposed under Research and Marketing Act project No. 124 on quality improvement of peanut products, which included the peanut butter investigation, and recommended continuation and broadening of work under this project.

Economic Importance of Peanut Products.

The importance of peanuts as a food is attested by the fact that in the 1951-52 season about 540 million pounds of edible grade, raw shelled peanuts were utilized directly by industry in the manufacture of primary products. About 120 million pounds (22%) was used in the manufacture of peanut candy, about 140 million pounds (26%) in the manufacture of salted peanuts, and about 274 million pounds (50%) in the manufacture of peanut butter. Miscellaneous other products accounted for the consumption of about 6 million pounds. The present value of the raw material alone exceeds $109 million, and of course, the value of the finished products is several times that amount.

Summary of Previous Research on Edible Peanut Products

As might be expected, a great deal of interest has been manifested in the development of peanut products of improved quality, and considerable emphasis has been placed on improvement of quality of the raw material and particularly on improvement of methods of manufacture. At the same time fundamental research on peanuts has not been entirely neglected, and valuable contributions have been made in this direction.

Salted Peanuts.

In the case of roasted or deep-fat fried peanuts attention has been centered largely upon overcoming the troublesome tendencies of these products to become rancid and stale in a relatively short time following manufacture. The keeping qualities of salted peanuts have been improved by use of more completely saturated vegetable oils for deep-fat frying, by eliminating contact with metals such as copper which have a tendency to produce unpleasant tastes and odors, by packing the product in a vacuum or in an inert atmosphere, by storing products under careful conditions of humidity, by application of antioxidants in the cooking oil or on the surface of the product, and by reducing absorption of moisture through use of salt containing drying agents.

Peanut butter.

In the case of peanut butter probably the prevention of oil separation has received more consideration than any other aspect of the manufacture of this product. The industry has favored processes involving use of more or less completely hydrogenated peanut oils as the "stabilizing" substances. Addition of other substances, including honey, coconut oil, and mono- and di-glycerides, have been suggested, but their use has not been widespread.

Stickiness of peanut butter in the mouth has been reported to have been diminished by incorporation in the product of such substances as glycerine, a proteolytic enzyme, lecithin, sugar, and unground pieces of peanut.

Various workers have reported on peanuts and peanut butter as a source of thiamin, riboflavin, niacin, nicotinic acid, and tocopherols, and on the presence of iron, manganese, copper, calcium, and phosphorus in peanuts.

Research on Peanut Butter at the Southern Regional Research Laboratory

In general, the peanut butter research program of the Southern Regional Research Laboratory was that recommended by the Peanut Advisory Committee. Its principal objectives were:

(1) An investigation of the manufacture of peanut butter to produce information on the effects of processing and storage on the quality of the product, i.e.,

(a) with regard to development of rancidity, and staleness;
(b) with regard to thiamine content;
(c) with regard to oil separation

(2) Improvement of processing equipment; and

(3) Development of laboratory methods of quality evaluation.

A complete 250-pound capacity pilot plant for the conversion of raw shelled peanuts into peanut butter was installed at the Laboratory, and facilities were established for constant-temperature storage, and analysis and evaluation of products.

Batches of No. 1 grade, white Spanish peanuts were processed by conventional methods into peanut butters which ranged in color from very light to very dark, depending on the extent of roasting of the peanuts. The products were placed in jars and stored in a room maintained at 80° F., and were analyzed chemically and by a taste panel at the time of preparation and at intervals during storage.

Effects of roasting and storage on product quality.

Results show that careful control of roasting conditions is necessary for the production of peanut butter of optimum flavor and good keeping quality, and that the range in desirable roasting conditions is rather narrow.

Taste-panel tests indicated a preference for medium-roasted peanut butters stabilized with hydrogenated peanut oil for the prevention of oil separation, the average scores for such products being higher than those given to lighter-colored butters. In general, peanut butters stored at 80° F. and examined periodically by the panel were found to retain acceptable odor and flavor for as long as a year, after which the products developed objectionable flavors before any appreciable oxidative rancidity could be detected in the oils extracted from the products. Butters made from the heavier-roasted peanuts tended to receive unsatisfactory flavor ratings at an earlier age than butters made from the lighter- and medium-roasted peanuts.

Neither the content of salt, or the content of salt and various stabilizers in the peanut butters, nor the amount of roasting accorded the peanuts produced any reduction in the stability of the oils of the products.

Inasmuch as chemical tests indicated a high stability for the oils of these products, it was concluded that the objectionable flavors observed were characteristic of the non-oil constituents of the peanut butter.

Effect of roasting on the thiamine content.

Results of analyses show that from 74 to 97% of the total thiamine is concentrated in the kernel of the raw shelled peanut; and that the thiamine content of the peanut butters diminished with increase of roasting while the peanuts became darker. Generally, butters made from light-roasted peanuts retained about 20% of the original amount of thiamine; medium-roasted peanuts, less than 14%; dark-roasted peanuts, less than 10%; and very dark peanuts, less than 3%.

Prevention of oil separation with hydrogenated peanut oil.

In an investigation of the properties of both stabilized and unstabilized peanut butters it was concluded that the stabilized character of peanut butter results from the limited solution of the hydrogenated peanut oil with the natural oil of the product, and from the uniform distribution of the hydrogenated peanut oil in its original crystal form throughout the product. It was ascertained that feeding devices play an important role in the uniformity of distribution of the hard fat. In general, it was concluded that peanut

butter can be stabilized satisfactorily with about 1% hard fat, when the processing temperature during and after incorporation of the stabilizer does not exceed about 77° C. (170° F.); and that the amount of stabilizer should be increased appreciably, when processing temperatures after incorporation of the stabilizer exceed this temperature.

Miscellaneous information on effects of processing on peanut butter.

General processing information has been obtained which is useful to peanut butter manufacturers for controlling the quality of peanut butter and gaging the efficiency of specific operations. For example, facts are now available on the effects of roasting and other processing steps on oil content and free-fatty acid content of the kernels, on the oil content of separated peanut skins, on the percentages of peanut halves, germs, and skins resulting from the blanching operation, and on the percentage of unblanched and undesirable material remaining with the peanut halves after the blanching operation.

Times and temperature required for roasting peanuts from very light to very dark have been determined, and the moisture contents of peanuts before and after roasting have been reported for each product. Uniformly efficient blanching of peanuts was obtained regardless of the length of time and temperature of roasting. The split-nut blanching operation produced about 2% hearts, 4% skins, and 94% peanut halves. From 1 to 3% of the blanched peanut halves consisted of unblanched and/or discolored and foreign material which should be removed by a supplemental sorting operation prior to grinding into peanut butter.

The sorted peanut halves resulting after elimination of hearts, skins, and objectionable material contained a higher percentage of oil than the roasted kernels. Separation of the components of lower oil content is responsible for this difference. The skin of raw peanuts generally contains a very low percentage of oil. The high oil content, about 28%, of the skin blanched from the roasted peanuts results from transfer of oil from the peanut during processing, particularly during roasting.

The free fatty acids contents of the oils of the raw and roasted peanut, sorted cotyledons, and of the peanut butters, freshly prepared and over a two-year storage period, were uniformly low, 0.3% or less, indicating that the product is high in quality from this standpoint.

Objective method for measuring color of peanut butter.

The color of each of the peanut butters produced in this investigation was determined by a spectral reflectance method. Information obtained establishes that the colors of peanut butter can be measured objectively by reflectance spectro photometry, and provides the basis for measurement of the color of peanut butter with less complicated and less expensive equipment. Colors were expressed by several different systems, i.e., I.C.I. (C.I.E.) trichromatic coordinates, Munsell renotations, and Hunter scale numbers.

Methods of analysis.

Several analytical procedures were developed in connection with the evaluation of peanut butters and their constituents. One was a modification of an existing technique for determination of the stability of vegetable oils which reduced the time of determination by 60%. A stability tube and foam breaker developed for use in the analysis of crude peanut oils with such methods overcame the excessive loss of peanut oil occasioned by the conditions of the methods.

A modified toluene distillation method was found to give consistently reproducible values for moisture content of peanut butter. Inconsistent results had been obtained in the application of the usual methods for moisture in agricultural materials.

Relation of variety of Peanuts and Quality.

As a result of observations that products made from different types of peanuts vary in stability or their resistance to oxidative deterioration, an investigation was made to determine whether these differences could be attributed to fatty acid composition, tocopherol content, or trace metal content of the crude oils.

In general, it was found that the stability of the crude oil was greatest for the oils containing the smallest amounts of linolein. A wide variation was found in the linolein content of the oils from different types of peanuts, ranging from 20 to 37%. Oils from peanuts of the so-called "prostrate" types, particularly "runners" and some "Virginias" contained the least linolein and were the most stable. Oils from the bunch types, particularly the "Spanish", contained larger amounts of linolein and were less stable. The tocopherol contents of the oils extracted from the peanuts were not found to vary significantly, although the tocopherol contents of the oils of the runner peanuts were generally higher than those of the other oils. Trace metal contents of the oils of these peanuts were found to be less than 0.2 p.p.m., and were not found to vary significantly.

It may be concluded from these results that products made from peanuts of relatively low linolein content and of high stability would have an increased shelf-life. This work points to the desirability of obtaining further information regarding the composition of peanuts and stability of oil.

Summary of Results

Careful control of roasting conditions is necessary for the production of peanut butter of optimum flavor and good keeping quality. The oil in peanut butters satisfactorily resists the onset of rancidity during storage for two years at 80° F. regardless of the amount of roasting accorded the peanuts, or incooporation of salt and hydrogenated peanut oil in the product. Most of the thiamine content of the peanuts is concentrated in the peanut halves or cotyledons. The thiamine content decreases with increase in the extent of roasting as the peanuts become darker in color.

The "stabilizing" effect of hydrogentated peanut oil in peanut butter depends to an appreciable extent upon the crystalline condition of the hard fat prior to its incorporation. The optimum effect can be achieved only if the greater part of the hard fat remains in, or reassumes, its original crystalline condition on completion of the processing operations, and if the hard fat is uniformly dispersed throughout the peanut butter.

Information about general processing and methods of analysis of peanuts and peanut butter has been obtained which is of interest and useful to peanut butter manufacturers for controlling the quality of peanut butter and gaging the efficiency of specific operations.

An investigation of the relation of composition and stability of the oils of different varieties of peanuts indicates that products made from peanuts of relatively low linolein content and of high stability would have increased shelf-life.

The original program of research planned for the investigation of the processing of peanut butter has been completed. Much of the work has already been published or is now in manuscript (see attached list). In addition, a complete review of this investigation will be published as soon as the preparation has been completed.

Further Research on Utilization of Peanuts

As a result of informal conferences of members of the Southern Regional Laboratory with representatives of the peanut industry and research workers from state and federal agencies concerned with research on peanuts, it was concluded that a research conference on factors which affect the utilization of peanuts would be of benefit to the peanut industry and would be helpful in determining the types of utilization research that would be of greatest help to the peanut industry. This conference has been planned to achieve that purpose. The recommendations resulting from this meeting should have a profound effect on our future research program. Also, in view of the attendance at this meeting of research workers in state and other federal agencies, as well as the outstanding representation from the peanut industry, it is presumed that the results of these discussions will have considerable influence beyond the scope of this organization.

List of publications, manuscripts, etc. resulting from research on improvement of quality of peanut butter at Southern Regional Research Laboratory

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Patents:

Fisher, G.S., and Morris, N.J., An improvement in aerator outlet. Patent being applied for.

Willich, R.K., and Freeman, A.F., An improved mechanical feeder. Patent being applied for.

THE NEED OF THE ARMED FORCES FOR PEANUT PRODUCTS

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Your invitation to attend and participate in the 1953 research conference on the utilization of edible peanuts was received with pleasure and I have looked forward to being with you today.

It is with a feeling of solemn responsibility that I begin this talk by saying that I have carried into this room concealed on my person, a ration component that has not yet -- anywhere in the world -- been seen by anyone. I am not sure that I am justified in having this remarkable item on my person, since I have not yet had it cleared -- and it may have security implications. Its military characteristics are astonishingly high; its stability is close to amazing; partly a result of its unique packaging -- a double wrap, both of which conform to the shape of the item. If the item were actually classified I would not be able to divulge its nature even to this research group, but inasmuch as it has not been, and because of the fact, this group may find the item of particular interest, I am going to divulge my secret at the end of my short talk on "The Need of the Armed Forces for Peanut Products." I assure you that no other group or organization will ever have the opportunity of seeing this item again.

One function of the Quartermaster Corps, of which the Food and Container Institute is a small but important part, is to procure suitable and sufficient food for the Armed Forces. One goal of the Food and Container Institute is to see that the American men and women in uniform continue to be the best fed fighting forces in the world. Warfare today is quite different from yesterday, and tomorrow it may be still different. We must maintain a mobile, striking or defensive force, and that calls for rations that are not too bulky -- they must be of high caloric density. They must be capable of increasing battle efficiency, they must preserve life, they must be readily available in large quantities in wartime without upsetting the civilian economy, and of course, they must have the usual characteristics of high acceptability, good utility, and unusually good stability under all climatic conditions.

Peanut butter is one of the most valuable foods that we know of. It has all of the desirable characteristics for use in military rations and is the most highly concentrated food item of all of our items, having over 600 calories per 100 grams. In addition to its forty-five percent fat content, peanut butter has about thirty percent protein, which makes it an excellent substitute for meat. Comparing it with hamburger, for example, we find that 60 grams of peanut butter is equal to, or better than, 100 grams of hamburger in calories, protein, fat, carbohydrate, ash, calcium, potassium, Vitamins

B_1, B_2, and Nicotinic Acid. With the exception of methionine, it is a complete protein of relatively high biological value, and it is not inconceivable, that someday soon, the peanut butter manufacturers will be enriching their product with this readily available and not too expensive essential amino acid.

Another goal of the Food and Container Institute is to provide food of a type and quality as near like the commercial products as possible. Peanut butter again meets this goal for it needs no special treatment for military procurement as do many of our foods. A recent survey by the Owens-Illinois Glass Company, conducted for the purpose of learning from families the factors which tend to influence the purchase of peanut butter, showed that 94 percent of all families contacted used peanut butter regularly in the home. We, who are responsible for military rations, could not overlook such a universally accepted food. Those of you who attended the National Peanut Butter Manufacturers Association meeting in 1951 may recall a statement I made at that time to the effect: "I can't think of any better product for inclusion in the operational rations than good quality peanut butter. I expressed surprise that the industry had not exerted themselves to have peanut butter included in the operational rations, and I assured the group, that as soon as we were convinced that the product would be stable for at least six months at 100° F., we would recommend its inclusion in the rations." Incidentally, when I speak of rations, I refer to the operational rations -- those that are designed for individual or small group feeding afield. We have since completed our stability studies of peanut butter, and I am happy to report to this group that peanut butter will be included in the next procurement of 5-in-1 rations and the recently developed 25-in-1 rations. It will also be added to the Combat ration, just as soon as we have found processors with equipment capable of filling efficiently our 1 1/2 ounce cans. With very few exceptions, most of our samples of peanut butter remained highly palatable even after 18 months at 100° F. It was found that peanut butter made from Runner peanuts has at least as high or higher an acceptance as that made from Virginia or Spanish peanuts. It is safe to say that when the product met the proposed specification limitations on Peroxide Value of 5 millequivalents/kgm of fat and an AOM minimum of 30 hours or more that the peanut butter will be highly acceptable at time of consumption even after 18 months of possible storage.

Another goal of the Food and Container Institute is to make the overall ration as nutritionally complete as possible. Because of processing difficulties, it is not always possible to retain the naturally occurring vitamin content of certain food items and we must resort to the balancing of the whole ration by exploiting the use of "good carriers" in order to assure an adequate intake of all essential factors. For example, all of our beverage items; soluble coffee, soluble tea, cocoa beverage powder and citrus beverage bases are fortified with 20 mgm. of ascorbic acid per serving. We use the beverages as a carrier for this all important vitamin for we know they will be consumed, because of their high acceptability. The ascorbic acid is stable in this dry, well packaged product and does not adversely affect the flavor of

the beverage. About a year ago we felt that peanut butter might be a good carrier for thiamine and Vitamin A since these vitamins were deficient in the rations and the peanut butter appeared to be holding up well under all temperature conditions tested. We initiated a project to determine its acceptance and stability when fortified with Vitamins A, B_1, and C. Samples were prepared commercially and fortified to supply in 1 1/2 ounces of peanut butter, one-half the recommended daily allowances of the National Research Council plus an overage to compensate for losses due to processing. All samples were packed in hermetically sealed, 5 ounce cans and placed in storage at -20° F. and 100° F. The control sample was also stored at 40°F., for taste testing purposes only. After storage for one year, samples were submitted to our Acceptance, Stability and Nutrition Divisions for palatability tests, peroxide values and vitamin content determinations respectively. You will be interested, I believe, in the findings.

No deterioration in palatability was evident in any samples stored at -20° F. for 12 months. The control sample showed some signs of deterioration at 40° F. and 100° F., but not to the point of being unacceptable. The fortified samples showed no appreciable loss in Vitamins and those containing Vitamin C showed higher acceptability than any of the other samples including the control due probably to its pronounced antioxidant effect. It is safe to predict that peanut butter may soon serve another useful purpose in our rations by acting as a carrier for much needed vitamins. So much for peanut butter except to say that approximately 6 1/2 million pounds of peanut butter were purchased by the Chicago QM Depot in the 12 month period ending last October, and an equal quantity is likely to be procured in the next 12 months.

A few words about peanuts. It has been found that if peanuts are properly handled, prepared and packed in an inert atmosphere immediately after roasting and salting, they will remain in excellent condition for several years. We had occasion to examine some a few weeks ago that were purchased during World War II and found them to be just about as edible as freshly roasted peanuts. This type of pack is suitable for small or large group feeding, but no satisfactory small package for salted peanuts has been developed for individual rations. Confections containing peanuts or peanut butter cannot be included in the rations yet because of inadequate packaging protection. Experimental Research is being conducted on coatings for peanuts which will act as protective barriers to air and moisture. We have found that zein applied in an alcohol solution to freshly roasted peanuts not only gives considerable protection, but acts as an insect repellent. The latter finding was somewhat accidental, but nevertheless may prove to be very significant. A patent has been applied for this process. Further work is continuing along these lines for it is very important from a morale point of view, that peanut confections be included in the rations, for nut rolls are the most popular candy bars on the market today. More research is needed on newer antioxidants and methods of application together with coatings for peanuts and nuts before such products can be used in our operational rations. The deterioration of peanuts and peanut products is not entirely due to

oxidation of the oil. It has been noted that the flavor of peanuts, over a period of time, gradually weakens and eventually disappears. This may be due to protein breakdown -- frankly, we do not know, nor have we pursued this problem. A solution may be forthcoming as a result of this conference. Thank you for your kind attention.

Oh yes, -- I promised you earlier that I would disclose for the first time to any human being, an item used as a component of our A & B rations (Open and remove peanut from its shell - show it to the audience) I also assured you it would never be seen again (proceed to eat it). The moral of this demonstration is that when it comes to research and development, we all have to counsult Mother -- perhaps we should say Dr. -- Nature. She has a pretty fair development program going on for a good many years!

ROLE OF COMPOSITION IN UTILIZATION OF PEANUTS FOR EDIBLE PURPOSES

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The important position peanuts have attained in the dietary of the United States may be attributed to their chemical composition and physical properties. Peanuts are an excellent source of food oil and protein. The roasting process employed in preparing them for use as salted and roasted nuts, in candies and bakery products, and in the manufacture of peanut butter imparts a desirable aroma and flavor which contribute to consumer acceptance. A thorough knowledge of the composition and characteristics of the constituents of the peanut kernel is basic to improving the quality of peanut products for edible uses.

The kernel consists of two cotyledons and the heart (germ) enveloped in a thin skin (testa). These portions of the kernel differ markedly in chemical composition.

Composition of Kernels

The literature reports a large number of feeding stuff analyses of kernels. The ranges and average values of the constituents tabulated in Table I are the results of the work of a number of investigators. The average of the results of analysis of the kernels of Spanish, Runner, and Virginia peanuts from the 1942 domestic crop are given in Table II. These data indicate that on a dry basis peanut kernels contain approximately 50% oil and nearly 30% protein.

Like most edible vegetable oils the oil of peanuts consists of the glycerides of long chain fatty acids. As shown in Table III the fatty acids present include oleic, linoleic, palmitic, stearic, arachidic, and lignoceric.

The phosphatides, lecithin and cephalin, occur in the sludge which settles out of the crude oil. Though the peanut oil phosphatides have not been thoroughly investigated, Rewald has found that they consist of almost twice as much cephalin as lecithin.

Antioxygenic constituents, consisting of tocopherols and related compounds, are also present in the oil to the extent of from 0.03 to 0.05%. Fisher reported 0.018-0.030% alpha-tocopherol and 0.018--0.022% gamma-tocopherol in the crude oil. Delta-tocopherol has also been identified but beta-tocopherol

1/ One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

TABLE I. Composition of Peanut Kernels

Constituent	Range	Average
	%	%
Moisture	3.9 - 13.2	5.0
Protein	21.0 - 36.4	28.5
Lipids	35.8 - 54.2	47.5
Crude fiber	1.2 - 4.3	2.8
Nitrogen-free extract	6.0 - 24.9	13.3
Ash	1.8 - 3.1	2.9
Reducing sugars	0.1 - 0.3	0.2
Disaccharide sugar	1.9 - 5.2	4.5
Starch	1.0 - 5.3	4.0
Pentosans	2.2 - 2.7	2.5

TABLE II. Average Composition of Peanut Kernels from the 1942 Crop (Moisture-Free Basis)

	Spanish	Runner	Virginia
Number of samples	172	123	84
Oil	50.8 %	50.3 %	48.4 %
Nitrogen	4.93%	4.84%	4.77%
Nitrogen (oil-free basis)	10.01%	9.74%	9.27%
Protein (N x 5.46)	26.92%	26.41%	26.05%
Iodine number of the oil	95.7	91.6	93.6
Free fatty acid of oil	0.4 %	0.65%	0.3 %

TABLE III. Composition of Peanut Oil 1/

Glycerides	Variety Unknown	Spanish	Virginia	Senegalese	West Africa
	%	%	%	%	%
Oleic	55.7	52.9	60.0	65.7	71.5
Linoleic	25.9	24.7	21.6	19.2	13.0
Palmitic	8.3	8.2	6.3	7.2	6.0
Stearic	3.1	6.2	4.9	2.6	3.0
Arachidic	2.4	4.0	3.3	2.6	3.5
Behenic	3.1	---	---	---	---
Lignoceric	1.1	3.1	2.6	2.6	3.0
Unsaponifiable material	0.4	0.2	0.3	---	---
Total	100.0	99.3	99.6	99.9	100.0

1/ Calculated as simple triglycerides.

has not been found in peanut oil. These constituents contribute to the excellent stability of peanut oil and other peanut products containing the oil.

Klostermann and Optiz reported 247.9 mg. of phytosterol, a portion of which is esterified, per 100 g. of oil. This makes up the greater portion of the unsaponifiable fraction. Minor constituents in this fraction include higher hydrocarbons, methyl nonyl ketone, methyl nonyl carbinol, terpenes, and squalene. These constituents no doubt contribute to the characteristic odor of raw peanuts.

A number of workers have investigated the protein of the peanut kernel. In 1916 Johns and Jones isolated and described two globulins which they named arachin and conarachin. About one-fourth of the protein is conarachin which is more soluble than arachin. Additional work indicates that neither arachin nor conarachin is a pure protein. Electrophoretic analysis shows the presence of two major and two minor components in peanut protein. Arachin consists of only the two major components while conarachin consists of one of the major and both of the minor components. The protein remaining after removal of arachin and conarachin consists largely of the minor components. This residual protein contains 2.9% sulfur, a particularly high sulfur content for a vegetable protein.

One of the important criteria of the nutritional value of a protein is its content of amino acids. The amino acids found in arachin, conarachin, and total peanut protein are shown in Table IV. It can be seen that peanut kernels contain appreciable amounts of 10 of the nutritionally essential amino acids. Feeding experiments indicate that arachin is deficient in tryptophane and methionine and also in a third factor, possibly isoleucine. Conarachin, on the other hand, according to Baernstein is an excellent protein for growth when fed as the only source of protein. Baernstein also reported that whole defatted peanut kernel, total peanut protein, or total peanut globulin are approximately equivalent to casein in promoting growth. These findings were confirmed recently by other investigators. It is therefore apparent that the peanut is an excellent source of the essential amino acids. The digestibility coefficient of peanut protein from unroasted peanuts has been found to be 93 using human subjects.

The peanut kernel contains about 4% of starch, about 2% of cellulose, and about 4% of pectic material which is a complex of araban with pectic acid. The only sugar present in appreciable quantities is sucrose which makes up 2 to 5% of the peanut kernel.

Peanuts contain practically no vitamin A or D, but the kernels are an excellent source of the B vitamins. (See Table V) They also contain appreciable tocopherol (vitamin E). Vitamin K is probably also present, as well as small amounts of ascorbic acid.

The ash content of peanut kernels is not high, most reported values being between 2 and 3%. The array of inorganic constituents found in the peanut are listed in Table VI.

TABLE IV. Amino Acids in Peanut Proteins

	Total Protein	Arachin	Conarachin
	Wt. %	Wt. %	Wt. %
Glycine	5.6	1.80	
Alanine	4.2	4.11	
*Valine	8.0	1.13	
*Leucine	7.0	3.88	
Cystine	1.9	1.51	3.00
Aspartic acid	5.8	5.25	
Glutamic acid	19.2	16.69	
Tyrosine	4.4	5.50	2.86
*Phenylalanine	5.4	2.60	
Proline		1.37	
*Tryptophane	2.0	0.88	2.13
*Arginine	10.6	13.51	14.60
*Lysine	3.4	4.98	6.04
*Histidine	2.1	1.88	1.83
Ammonia		2.03	1.90
*Methionine	1.2	0.67	2.12
*Threonine	2.9	2.56	2.02
Serine		5.20	4.99
Hydroxylysine		0.01	
*Isoleucine	4.3		

*Nutritionally essential

TABLE V. Vitamins in Peanut Kernels

Vitamin	Amount Present
B vitamins	
Riboflavin.	1.05 - 1.57 µg/gm.
Thiamin	8.5 - 14.0 "
Nicotinic acid	88.0 - 200.0 "
Niacin	144.0 - 158.0 "
Pantothenic acid	25.0 "
Pyridoxin	3.0 "
Biotin	0.34 "
Inositol	1800. "
Folic acid	2.8 "
Vitamin C (ascorbic acid)	5.8 mg./100 gm.
Vitamin E (tocopherol)	11.9 "
Carotene (pro-vitamin A)	Present
Vitamin K	Present

TABLE VI. Inorganic Constituents in Peanut Kernels

	In Kernel		
	%		
Potassium	0.68	-	0.89
Sodium	Trace		
Calcium	0.02	-	0.08
Magnesium	0.09	-	0.34
Phosphorus	0.25	-	0.66
Sulfur	0.19	-	0.24
Chlorine	Trace		
SiO_2	0.08		
Zinc	0.0017	-	0.08
Manganese	0.0008	-	0.05
Iron	0.0018	-	0.10
Cobalt	0.00003		
Copper	0.0007	-	0.03
Boron	0.0026	-	0.05
Fluorine	0.00014		
Iodine	0.00002		
Strontium	0.0008	-	0.005
Barium	0.008	-	0.03
Vanadium	0.01	-	0.05
Chromium	0.001	-	0.03
Aluminum	0.1		
Nickel	0.003	-	0.008
Titanium	0.03	-	0.08
Molybdenum	0.0008	-	0.003
Tin	0	-	0.005
Lead	0	-	0.05

The enzyme systems in the peanut have not been thoroughly investigated but the presence of several enzymes has been established. Both soluble and insoluble catalases were found by Loew. An active lipolytic enzyme and an enzyme which hydrolyzes glucosides were also detected. The presence of a trypsin inhibitor in peanut kernels has been reported. Phytase, glycerophosphatase, pyrophosphatase, and a proteolytic enzyme are also present.

A number of other minor constituents have been reported in peanut kernels, including phospholipids, choline, organic acids, and free amino acids.

Heart (germ)

The heart is fre uently separated from the rest of the kernel prior to processing for edible uses. This fraction represents about 2% of the whole kernel. As shown in Table VII the heart contains considerable oil and nitirogenous material and its ash constituents are similar to those in the whole kernel. A bitter principle is also present in the hearts but it has not as yet been identified.

Skin (testa)

The skin of the peanut, which makes up about 3% of the kernel is frequently removed by blanching in the preparation of edible products. The average composition of the red skin of the peanut is tabulated in Table VIII. These values indicate that it is high in fiber and ash and contains appreciable nitrogenous material. Fuchs found 17% protein and 18% fat, but probably pieces of kernel were included in the samples he examined. Pickett found the red skins contained about 7% tannins. The skins from the white varieties of peanuts, not commercially available, were practically free of tannin. Stansbury reports that the native pigment is predominantly a catechol-tannin which gives a dark red phlobaphene on treatment with acid. These tannin materials contribute to the bitter flavor of peanut product from which the skins have not been removed. Other pigments which are present in red skins in smaller amounts include leuco-anthocyanin and a flavanone. Booher reported the red skins contained 7.9 mg. of thiamin per 100 g. Pickett also found that the thiamin content is very high. Since thiamin is heat labile the content of this vitamin is reduced considerably in roasting.

Compositional Changes Due to Roasting

Any consideration of roasting must recognize the effects due to interaction between the various constituents as well as those involved in thermal decomposition and loss of volatile products. Since peanuts are roasted in processing them for most edible purposes, the changes brought about during the process are of considerable interest. In general as the internal temperature of any foodstuff increases, changes occur more rapidly and become more complex. The internal temperature of relatively dry materials, such as peanuts and coffee, rises rapidly in processing and the effect of heat is pronounced. Peanuts, with an initial moisture content of 4 to 6%, are roasted at an internal temperature of 265 to 300° F. and the moisture in the finished product

TABLE VII. Average Chemical Composition of Peanut Hearts (Dry Basis)

Constituent	Spanish Germ	Runner Germ
	%	%
Oil	42.41	41.23
Nitrogen	4.53	4.08
Ash	3.07	2.94
Calcium	0.07	0.06
Magnesium	0.22	0.23
Chlorine	0.01	0.02
Sulfur	0.18	0.15
Potassium	0.75	0.80
Phosphorus	0.54	0.65
Phytin		0.50
Iron	0.0034	
Crude fiber	1.8	
Reducing sugar	7.9	
Total sugar	12.0	

TABLE VIII. Average Composition of Red Skin of the Peanut

Constituent	Percent
Moisture	9.0
Protein	12.7
Fat	11.8
Fiber	34.9
Ash	11.2
Catechol-tannin and other pigments	7.0
Carbohydrates	13.4

is generally lowered to about 1%. Extensive studies have been reported on the roasting of coffee, but very few investigations have been undertaken to establish the influence of processing on peanuts. Workers at the Georgia Experiment Station have demonstrated that a large portion of the thiamine is destroyed, while nicotinic acid, chloine, and riboflavin are reduced but little by roasting. Although proteins are denatured as shown by the change in solubility in water and salt solutions, their original amino acid content and nutritive value is apparently unchanged by moderate heat treatment. There is no appreciable change in the free fatty acids in the oil as a result of roasting. The apparent total sugars decrease when peanuts are subjected to a heavy roast, but the starch content is not significantly altered.

A number of constituents have been identified in the volatile materials which are expelled during roasting. These include relatively large amounts of carbon dioxide and small amounts of furfural derivatives, vanillin, ammonia, hydrogen sulfide, and diacetyl. Most of these constituents have also been identified in the volatile substances expelled in the roasting of coffee. It therefore seems likely that similar changes in constituents are involved in roasting both peanuts and coffee. Consideration of the properties of the various constituents and their behavior under the influence of heat suggest that the following changes take place. The sugar probably undergoes carmelization to some extent and at the same time reacts with the free amino groups of the protein and with the free amino acids to produce nonenzymatic browning. The browning reaction is extremely complex and its mechanism is not thoroughly understood. It is known, however, that the reaction of sugars with amino acids produce characteristic flavors and aromas. The products evolved in this reaction include carbon dioxide and furfural derivatives, both of which have been identified among the products volatilized when peanuts are roasted. It should also be pointed out that when extensive browning occurs there is usually a loss of nutritive value of the protein.

The polysaccharides present, such as the arabans, are degraded and possibly decomposed by heat. There is also probably some thermal decomposition of the protein since sulfur compounds have been identified in the volatile matter. The characteristics of the oil undergo very little, if any, change but the lower viscosity of the heated oil allows it to penetrate and wet all parts of the kernel. Other changes which also take place include inactivation of the enzymes, destruction of heat labile vitamins such as thiamin, and changes in the overall acidity.

Summary

Peanut kernels contain approximately 50% oil and 30% protein. The oil consists of the glycerides of long chain fatty acids and contains tocopherols which serve as antioxidants, contributing to its excellent stability. The protein has a high digestibility coefficient and contains appreciable amounts of 10 of the nutritionally essential amino acids. Carbohydrates present in the kernel include starch, sucrose, pectic materials, and cellulose. Although peanuts contain practically no vitamins A or D they are an excellent source of the B vitamins. They also contain small amounts of a number of inorganic constituents and several active enzyme systems.

Peanuts are roasted in preparing them for most edible uses in order to develop desirable aroma, flavor, and palatability. Consideration of the chemical constituents of the peanut suggests that the following changes take place during the roasting process. Moisture and other volatile constituents are driven off. Proteins are denatured and react with sugars to produce nonenzymatic browning. Sugars undergo caramelization and some of the polysaccharides are degraded. The oil undergoes practically no chemical change but flows throughout the kernel, wetting the entire cellular structure. Enzyme systems are inactivated and some heat-labile vitamins are destroyed.

UTILIZATION PROBLEMS IN THE PEANUT BUTTER INDUSTRY

WHICH MIGHT BE RESOLVED BY RESEARCH

By

William K. Kuehn, President
Good Foods, Inc.
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I want to express at the beginning my thanks to Mr. Freeman for his very kind invitation to address this group, but I am going to admit that I am not too certain of what he wished me to speak about. This is primarily a technical group, and I am not a technical man, so I don't know that I can tell you about utilization problems in the peanut butter industry which might be resolved by research. I can, however, give you the viewpoint of one who is primarily concerned with the marketing of peanut butter, and who feels that research does and can play a very vital part in this marketing.

The peanut butter manufacturer works at the consumer level, the end of the peanut line, so to speak. At this level, he is primarily concerned with the quality of the products he sells and the prices at which they sell. Everyone here recognizes the part that intelligent research plays in the quality of any product, but it is not as readily admitted that quality, in turn, plays a very important part in our selling prices. I think it must be admitted, however, that selling prices are derived from costs, and I believe costs can be lowered through the proper research.

The battle for the consumer's stomach has never been more competitive than it is today. There is no question in my mind but that every peanut butter manufacturer is in a poor position to wage this battle because of the quality of the peanuts he receives for processing, and the prices he pays for these peanuts. For each of the past several years we have had to work with lower quality peanuts at higher prices. This is a situation over which we have no control, yet we are the ones who must sell peanut butter to the consumer, and she is not as foolish or unobserving as many would like to think. The mass of consumers recognizes value for their money, and it simply hasn't had the right value in peanut products for some time.

Unfortunately for all of us, the selling price of a product is the most important item in the marketing of a product, and there is very little the research man or the end user can do about the prices of raw peanuts. This is a matter settled each year by the Commodity Credit Corporation.

Well, then, what part can research plan in this struggle to restore real value to peanut products? There is much it can contribute, both in improving the quality of peanut products and reducing the prices of peanut products. Let me talk about quality first.

In the matter of quality, two things are most important in peanut butter -- the appearance and the taste. In appearance, a manufacturer will always have a uniform color because even unevenly roasted peanuts will blend into one color. Some manufacturers like to use No. 2 peanuts, but we feel that an excessive use of No. 2 peanuts usually results in the peanut butter having a rather dull appearance with a grayish cast, which some of us think is the result of the sweaty, open faces picking up dirt and carbon while in the roaster.

The other consideration in appearance is the speckiness of the product, and this is where a manufacturer, even those using only No. 1 peanuts, begins to run into serious cost troubles.

The specks you see in a jar of peanut butter are minute pieces of the red skins which have not been removed during a blanching operation. Our objective is to remove the skin from every peanut, but the skins simply cannot be removed from damaged or shriveled peanuts. Most of the butter manufacturers will supplement their blanchers with pickers, but even so, the manufacturers have not been able to clean up their products satisfactorily, even when, as in our case, the maximum number of pickers has been employed. A specky looking peanut butter is not appetizing looking, and is easily noticed by the consumer. This problem is, however, one that a peanut butter manufacturer cannot solve -- economically or physically. It is a matter that could probably be solved by the grower if he knew how and if he would do so.

In the matter of taste, there are probably as many different opinions as there are manufacturers. When I first came into the business, the general rule was that the best peanut butter was made from a mixture of Virginia and Spanish Peanuts. It has been my observation, however, that some manufacturers insist upon all Virginias, some others will use all Spanish, others all Runners. A good percentage of manufacturers blend peanuts. There is no wide agreement on any one of these possibilities.

There are many good reasons for using just one type, and an equal number of good reasons for blending. When one is using a single type, for instance, he can set his blanchers to the most efficient point. This is a highly important shrinkage factor. He is also generally working with peanuts of relatively the same moisture content, which enables him to get an even roast. In working different types of peanuts at the same time, a manufacturer will often get an uneven roast, the low moisture peanuts roasting dark and the high moisture peanuts roasting light. This is objectionable because, to use a broad example, semi-burnt peanuts and semi-raw peanuts will produce a uniform color, but will not produce a good taste. On the other hand, combinations have attractive points also. The weak points of one type of peanut can be offset by the strong points of another type. Again using a broad example, I believe Virginia Peanuts are generally considered the best tasting peanuts, but they are also the most expensive. They might be combined with Runner Peanuts satisfactorily, however, the reasoning being that the Virginia Peanuts will bring up the taste, while the Runner Peanuts will bring down the overall cost.

No matter which peanut is being used, the damaged content is highly important. The peanut butter manufacturer has an advantage over the nut salter or candy manufacturer in that he can grind up the damaged peanut and make it disappear, except for its part of the speck content, but a damaged peanut ground up in a jar of peanut butter has the same general effect on that jar as the rotten apple in a barrel. That damaged peanut can be tasted, and we know a rotten peanut has no business being in there. Once again, however, the ordinary peanut butter manufacturer does not have the physical means to remove these peanuts economically.

From a cost standpoint, we are again concerned primarily with taste and appearance. The purpose of a blancher is to remove every red skin, and we honestly try to do just that. Our shrinkage costs run up rapidly, however, when we are working peanuts with a high content of small shriveled or damaged peanuts. This is so because we have to tighten down our blanchers in an attempt to clean up these troublesome peanuts, with the result that we take entirely too much meat off the good peanuts. Picking too is expensive, without regard to the labor cost involved. Put it this way -- for every pound of peanuts we pick out, we lose about 12¢ a pound. For every pound of skins we get, we lose 16¢ to 17¢ a pound. It isn't difficult to see, therefore, that we are very much interested in holding our skin return and our pick outs to a minimum.

Moisture is primarily a cost problem. Whatever the moisture content of the raw peanuts going in, the moisture content of the peanut butter will be something less than 1%. The moisture loss is in direct proportion to the moisture accepted, and I guess a buyer is never entirely satisfied with the moisture content of the peanuts he receives. High moisture peanuts are also subject to mold and freezing.

Going from the peanut butter manufacturing plant to the sheller now, most of us manufacturers realize that a peanut sheller cannot give us exactly what we want unless we are willing to pay for it. He could, for instance, screen out the small shriveled peanuts which gives us trouble, but where would he sell these peanuts? About the only available market for them is in oil stock, and in such a sale he takes a substantial loss. If he removes these peanuts and sells them in the oil market, he must get a higher price for the peanuts he ships to us. It is either that, or get us to accept a certain percentage of these undesirable peanuts, and that, unfortunately, is generally the case. The sheller has very little control over the condition of the raw peanuts he receives, and the same calculations apply to damaged peanuts as apply to the small shriveled peanuts. He can clean them up, if the end user is willing to pay the cost for doing it. The same is true of moisture, and again with No. 2 peanuts. Theoretically, the sheller can give us exactly what we want, but his problem is what to do with the by-products. I am inclined to think that the sheller is sitting in the middle on this, and that there isn't much he can do about it under the present type of Government operations.

Under recent programs, the Commodity Credit Corporation has been an active buyer of farmers' stock peanuts, in competition to the sheller. Conditions have forced the shellers to pay high prices for peanuts which have been over-graded in the first place.

In my opinion, the answer to our utilization problems lies largely with the farmer and those who control the support price program. Notwithstanding the prices, the quality of the peanut products we produce is a serious marketing handicap, and both the quality and the prices of our products cannot be improved until there is a real and a serious effort to do so on the part of the peanut growers. In this effort, research must take the lead, for only a considerable amount of study and experimentation will bring out improvements in the quality of the raw peanuts delivered to the peanut shellers.

My suggestion is that the various research organizations now existing in the Southern States curtail to a large extent their activities in applied research, the types of research that attempts to improve existing peanut products, and expand their activities in basic research aimed at eliminating the troublesome flaws in the raw peanuts. It is my feeling that applied research not only overlaps to a great extent the research which has been done and is being done by the end user group, but in many cases such research is directed against products which are already established. I don't feel, for instance, that public funds should be used to learn and to give others processes which certain companies have developed and used successfully. Secret processes are jealously guarded, and properly so, and we don't believe it a function of the publically supported research group to unlock those secrets. Their efforts, in my opinion, would be better spent on the problems concerning quality and strains of peanuts, problems which are common to everyone in the industry.

An improvement in the quality of raw peanuts would serve many purposes. It would go a long way towards eliminating one of the marketing handicaps under which we operate, the generally poor appearance of peanut butter; it would also go a long way towards reducing our selling prices, because of the excess costs a manufacturer must absorb in his efforts to clean up these peanuts; and, in fact, it would probably improve considerably the return of a grower on an acre of peanuts.

This last, in its turn, might make it possible to lower the support prices without lowering the grower's return per acre. Every effort on the part of the end users to get lower peanut prices, which we feel would enable us to get a larger peanut market, has been opposed by the grower groups on the theory that we were trying to reduce the farmers' income. I say that research may be able to compromise these opposing views, with large benefits to everyone in the peanut industry.

Lest I be misunderstood, I want to say that I am not opposed to the theory of support prices. It is, in my opinion, a theory designed to stabilize markets, which is always desirable. I am, however, definitely opposed to the methods by which peanuts have been handled under the support programs. I have given some examples of why I am opposed. Our approach to the problem is based on the assumption that a larger market for peanut products is what everyone in the industry wants. Therefore, we want better quality and lower prices.

As I begin to close now, I want to offer some suggestions as to specific types of research which may be done at the basic level to improve quality, the yields and the prices of peanuts. As one manufacturer, we have certain ideas of the quality we want to produce, and we want to produce this quality consistently. This is difficult under existing conditions. We have noticed that peanuts differ in taste from one section to another in the same growing area, and that the taste varies considerably from year to year in the same section. Why is this? Is it a difference in the weather, is there a difference in the soil from one year to the next, or is it a difference in the harvesting methods? We want and need a consistent quality. As an example of what I am talking about, General Mills has a product of which they are very proud called "Wheaties." The wheat that is used in "Wheaties" is purchased only from sections that have been determined as satisfactory to their needs. They can't use just any wheat in Wheaties, and we can't use just any peanuts in our product. Some profitable study could probably be made in this direction.

In our search for consistent quality, we have noticed that the damaged content and the small shriveled content vary from section to section and from year to year. Again, is this only the result of the weather, or is there some other reason? While we suspect that a good deal of it is due to indifference on the part of the farmer, who hasn't been exactly encouraged by the price support program to bring in quality peanuts, even such indifference might be overcome by proper education based on proper research.

Another question which occurs to me is whether the grower has all the knowledge he needs, and the proper knowledge, in regard to the proper maturing of peanuts. In recent years a practice of buying wet peanuts from the growers and frocibly drying them has started. While we feel that such forced drying reduces the flavor of the peanut, we are not at all sure, and would welcome some research aimed at the answer to this question.

I believe that damage in a crop is generally the result of unfavorable weather conditions during the harvesting season. If it could be established that forced drying does not affect the taste of the roasted peanut, it would seem that one of the hazards to quality, the long curing season, might be eliminated. Forced drying is a very important subject, in my opinion.

Do we have all the knowledge necessary in regard to soils and soil conditions: Do we know all we should know in regard to peanut strains? Do we know the part various metals play in peanuts, metals in the ground or in our processing equipment? I would like to say at this point that our Lee Avera, Director of Research for the Rosefield Packing Company, will offer a short addition to my remarks and briefly enlarge upon some of the technical aspects of research problems.

The problem of the utilization, or the use, of peanut butter which might be resolved by research, is, then, in my opinion, primarily a problem of quality and price. Until there is a change in the support program we are going to be handicapped by this situation, but we can work through research to offset the damage done to the peanut market. I believe we can show the grower that it is worth his while to produce quality peanuts. Ten to twenty percent of the crop must be lost or wasted each year because of inefficient or indifferent growing and maturing methods. I even question the wisdom of "hogging off" peanuts. I believe such a practice produces a flabby fat, making the hog less valuable at the market.

If research can further develop means by which the sheller can get higher returns for his by-products, for his hulls, for his oil stock and even for his No. 2 peanuts, then we should be able to reduce the high prices of No. 1 peanuts. Hulls alone equal almost 25% of the weight of farmers' stock peanuts, and are very often practically valueless. If a hull value of even $20.00 per ton could be established, the price of No. 1 peanuts could probably be reduced by 1/2¢ a pound. These reductions are important. It is at such things that we would like to see research directed. Without saying that the end products cannot be improved, we do feel there are very satisfactory peanut butters on the market, very satisfactory candy bars and very satisfactory salted peanuts. Without attempting to pun however, I suggest that the root of most of our problems is on the farm, and it is at that point that we should have more research. That, and research aimed at increasing the value of the by-products of a peanut shelling plant.

There are certain marketing facts of life which you must realize or my talk here is worthless. The public is accustomed to purchasing a 5¢ candy bar, and in an attempt to stay within that price the peanut candy bars have been reduced to almost ridiculously small sizes. It is interesting to me to note that a rise in the sales of cocoanut candy bars and soft centered candy bars closely parallels the increase in the cost of peanuts. You may regard it as a dead certainty, therefore, that a reduction in peanut costs will mean more peanuts used in candy. The peanut candy manufacturers will do this for competitive reasons. It is also reasonable to expect that the sales of salted and roasted peanuts will increase with a reduction in peanut prices, as they, too, are offering very small packages of peanuts for 5¢ and 10¢. Such items as popcorn, corn chips and potato chips happen to produce large sized packages, and those are some of the items in competition to peanuts. You may depend upon it that the manufacturers of those items will put any reduction of peanuts into an increase of the size of their packages, and they will do this for competitive reasons also.

As for peanut butter, I can remember when a 2 lb. jar retailed in Minneapolis for 17¢. Today, we really have to talk fast to get a 13 oz. jar retailed at 39¢, and in too many places it is sold at prices ranging from 42¢ to 45¢. That's quite a difference, isn't it? Does anyone really think that peanut butter of a generally poor appearance sells easily at these prices? We are up against competitive items which are good, and which are selling considerably cheaper than peanut butter. It is nice to sit and figure that the consumers

will always use peanut products in a certain volume and that it doesn't much matter what the quality is or what the price is, but it simply doesn't work out that way. We are fighting desperately to hold onto what we have, with the handicaps of poor quality and high priced peanuts hanging around our necks.

I was very much impressed with a remark once made by an officer of the National Peanut Council in writing about the Government Peanut Program. He said that "A Government guarantee of high prices for commodities the Government is not going to allow the farmers to raise is meaningless." By the same token, a good deal of the research which has been done and is being done is meaningless because it doesn't get at the problem that is most serious at every stage of the peanut market, the quality, and in turn, the price of peanuts. If you will get us a good consistent quality of peanuts from the grower, with which we can reduce our costs and selling prices, we manufacturers will get you and the industry a larger peanut market. Who knows, perhaps you can even put some real meaning back into the peanut program again.

ADDENDUM
to
Presentation of William K. Kuehn
on
Utilization Problems in the Peanut Butter Industry

by

F. L. Avera, Director of Research
Rosefield Packing Company
Alameda, California

We believe, gentlemen, that the most urgent research needs of our industry can be very simply stated. We are brave enough to say we think that something concrete can be said about these needs as well as about what to do towards solving these questions. The peanut industry, we feel, wants essentially three things from research.

(1) Knowledge how to cut the farmer's loss in yield and quality.

(2) Knowledge how to cut the loss through shrinkage and excess processing cost while peanuts are in the hands of the sheller.

(3) Knowledge how to cut the end user's loss through shrinkage, pick-outs, unacceptable flavor and excessive shelf depreciation.

Before talking about our suggestions for research into these urgent questions, I should like to mention how extremely helpful has been the basic or fundamental type of research for other industries connected with food.

It would be difficult indeed to over-state the benefit to the soya bean industry from the fundamental research done by the Northern Regional Research Laboratories. They have enabled end users to find applications for soya fat in foods because of the research done upon the amount and nature of trace things which cause bad flavor and loss of keeping stability in soya fat. We feel this type of research was of far more use to the soya industry than would have been simple research into novel formulas for products to use soya fat.

The Western Regional Laboratories have done similar fundamental research for the potato and rice bran oil industries, to name but two. Once again the immense value of truly fundamental research for industry was established.

Our industry would find similar fundamental research of tremendous, practical value. It would be of great use in solving the three general problems first outlined.

May we now present to you a few representative examples of specific and fundamental research projects. With each suggestion we will also offer an actual method of approach which we feel might prove fruitful.

Peanut Maturity

What relation does peanut maturity bear to the farmer's yield of sound peanuts? Does the ease and efficiency of curing relate to maturity? Does the keeping quality and flavor quality of the end product relate to peanut maturity?

We believe there is badly needed an accepted and reproducible standard for peanut maturity. We feel this should be first explored from a laboratory viewpoint and with laboratory methods. A method and technique for the farmer and shellers use might then be developed from the knowledge derived from such a study.

The relationships of peanut flavor, physical texture, grindability, freedom from inherent vice as well as peanut size, may well be directly concerned with the degree of peanut maturity.

For an approach to the problem of laboratory evaluation of maturity, we suggest that the microscopical examination of peanut cells might prove useful in finding a standard for comparison. Perhaps only the mature peanut will evidence seed coats in which only the perisperm cells have retained nuclei. Perhaps the average count of starch grain hilum per cell may prove to have a direct relation to maturity.

The appraoch to a farmer and sheller standard of comparison is difficult to suggest under the present conditions of limited knowledge about the fundamentals of maturity. Something on the order of a "tenderometer" might be developed for this use.

Peanut Drying

What is the exact route or mode of drying involved in the removal of water from field levels down to say five percent in the shellers warehouse? Would partial rain shields or covers over each stake, or stack of peanuts in the field, protect the farmer from water damage?

How much of the water is "free" and how much bound in cytoplasmic emulsion? Do we have a phase of water removal where only the equilibration of water vapor pressure is involved, followed by the need for enough extra energy to break the surface tension of a cytoplasmic emulsion? Should the drying of the farmer's harvest be approached by two distinct drying techniques, each directed to a different phase of water removal? If so, what are the moisture levels involved in each phase?

A great deal of attention has been given to the artificial drying of peanuts. We feel not enough attention has been paid to the fundamental issues involved in the natural drying of peanuts by the farmer and the

sheller in field and warehouse. If the fundamental mechanics were better understood perhaps an acceptable method of accelerated drying not as yet tried, might be devised.

We suggest a thermodynamic evaluation be made of the energy role in drying peanuts from field moisture levels to five percent moisture residual. If the experimental drying is done under strickt, analytical calorimeter conditions much basic knowledge could conceivably ensue.

Peanut Strains in Relation to Quality

What are the quantitative and qualitative relationships of peanut strains to the farmer's yield of sound nuts?

Why does the Virginia type peanut have less inherent vice than the Runner type?

What are the actual factors in both name and amount which give the Virginia peanut a sweeter and higher flavor than the Runner?

How does flavor and keeping quality vary with fat content and with peanut strain?

What and how much of each constituent represents the ideal peanut from flavor, yield, and the general quality standpoint?

We feel that a genuine quantitative and qualitative identification of the superior and inferior characteristics of each peanut strain has not as yet been made. We feel it should be made.

An approach to this problem, we feel, might include qualitative and quantitative identification of all carbohydrates present, with comparison of different strains. The same identification and comparison should be made of non-saponifiable substances, of chromatographic fractions from the liquid phases present, of various selective solvent removed fractions. The products of pyrolysis and ashing should be compared. The degree of metals complexed and free should be compared between strains.

The Systemic Role of Metals in Peanut Growth.

What relationship, if any, does the systemic absorption of metals by the peanut have upon the farmers yield and quality of harvest, the shellers processing costs due to damaged peanuts, the end users costs from all phases of quality deterioration or lack of quality?

What is the systemic absorption role of metals in peanut growth?

The relation of systemic metal absorption to peanut type should be explored.

Does systemic metal absorption always accompany metal complexing or chemical inactivation by compounds present in the peanut? If so, does this have an upper limit?

We have observed metal levels to vary over 100 parts per million in peanuts during the last year. This seems a significant variation to us.

This problem might be approached by evaluating metal incorporation by growing peanuts of all strains in soils of controlled metal content and of various metal contents both quantitatively and qualitatively. We feel the same study should be made under such agronomy practices as dusting with copper.

The unhappy experience with BHC in peanut growing areas should serve as a stimulus to seek more knowledge about the absorption of deleterious substances by growing peanuts. These should include such bad staling and rancidity causing metals as copper.

PROBLEMS IN UTILIZATION OF EDIBLE PEANUTS IN THE PEANUT SALTING AND CONFECTIONERY INDUSTRIES

C. E. Johnson, Vice President
The Kelling Nut Company
Chicago, Illinois

Mr. Chairman and Gentlemen:

I came to this conference without a written speech because I did not know just what I was expected to say. I did have a group of notes with certain ideas -- now I can throw most of them aside. After listening to Dr. Boswell and the other learned scientific men I realize that I am just a yokel on the subjects discussed. Most of what has been said is over my head and must be translated into language that, I, as a layman, can understand. It is evident that much has been accomplished already and many things are already known about peanuts. The past program for improvement of peanut butter dovetails or parallels with our needs, so that a start has been made. We just want to learn more.

We all agree that peanuts are good food and hold a high place in the role of American foods. They are packed full of excellent proteins and digestible fats and are a natural source of many essential vitamins. Truly peanuts are a concentrated energy food. Furthermore they seem to be universally liked, so we start with real advantages. Now what can be done to improve on those advantages, so that we, as an industry, will go forward?

It seems to me that Dr. Boswell is so right -- that it is fundamental, or basic, that our problems start -- and research should start -- at the farm level with variety testing, breeding, and correct harvesting and curing. Also, I agree with Mr. Kuehn, that price is a big factor. But, with present controls, we have little opportunity to do anything about it. Only through greater yields and better quality will farm prices come down to levels that will correct the price problem -- through lower costs.

Maybe I shouldn't say anything about my previous understanding that peanut seeds -- in fact, all legumes -- did not inbreed and that "like produces like", but that was the impression I got in a recent conference with Dr. Woodruff. I know so little about it. But, if that were so -- what accounts for the changes that have progressively taken place in the lower quality in Spanish peanuts these last several years?

No doubt there is much that can be improved upon in harvesting and curing. Maybe the project of artificial drying or curing can be developed without losing the flavor of peanuts and be most helpful at the shelling level and bring us peanuts that not only ship safely, but will store safely and blanch better.

At the shelling level, real conscientious effort can now produce better grading and cleaner peanuts -- but on this point I take issue with the price

buyer and say we should look into the mirror to see who else might be contributing or be at fault. After all, if we, as buyers, shop for price and will accept delivery of substandard grades, we are contributing. If, on the other hand, we insist on quality and will only accept quality, then we must also be willing to pay for quality. We can get it. Actually it costs less at the mill to properly clean peanuts than at our processing plants.

There are few, if any, real secrets in the nut-salting industry, although many may act mysteriously about their processes. I also believe that one poor salter, who turns out inferior products, can injure all the other surrounding good salters. It undermines or destroys consumer confidence and the taste for peanuts and peanut products. Here, in this research program, we may ultimately have the means to improve the processing methods of all the industry to the ultimate end that the whole industry,from farmer to consumer, may be the gainer. That, I believe, is the REAL objective of this conference.

Our industry has a multiplicity of problems:

1. Better quality of raw material
2. Better processing methods
3. Better packaging

Blanching methods now in use may be improved upon. Maybe new and better methods can be developed. Originally peanuts were water blanched, by hand, but this process was slow and costly. When the so-called dry method was conceived and developed, it was generally adopted. There may be ways and means that we can find to adopt the good features of both methods, combine them, and produce new improved blanched peanuts -- peanuts with better appearance and better flavor and texture, and, more important, with greater shelf-life. Also, maybe lower costs will result through savings in rejects and less splitting. I would be interested in knowing what happens to peanuts, at various stages, in all the possible processes known.

Cooking oils, at this particular time, are a major problem with most all salters. Before World War II most salters used coconut oil, and found it satisfactory. It always seemed to be a stable and satisfactory medium for cooking. As war became almost certain, we began to look around and we tested all the vegetable oils in hopes of finding a substitute for coconut oil which was almost certain to be a thing of the past. Most found that peanut oil was not only as good, but actually better and far easier to handle. We all learned how to do a good job with this new medium and in many plants new equipment was designed for it. Now we may find this fine oil also unobtainable, or economically unsound. So, again we are all testing substitute vegetable oils. Let's hope we find a still better one. Strangely, coconut oils don't seem to act like they did before the war. Maybe it's different equipment. Maybe it's just the fact that we may have lost the know-how. Maybe it is a change in the coconut oil. The oil chemists tell me they have improved refining and thought they had improved the coconut oil, but may have taken out something that inhibited foaming. At any rate FOAMING is the trouble. Now we are looking for something to add back to prevent foaming.

Temperatures and times of roasting should be studied to learn what effect heat has on the final product, with the purpose of producing the finest and most nutritious foods.

Antioxidants should be investigated, and we must learn if they can be used in cooking oils at temperatures up to 325° F., or if they are so unstable that they just spend themselves without benefit. Which antioxidants are the most desirable? Should antioxidants be applied in dressing oils or in salt -- and how much should be used?

Packaging is a big study. I am interested, for one, in what happens to peanuts in vacuum as opposed to packaging in nitrogen or carbon dioxide -- from the standpoint of shelf-life, true flavor, color and so on. Past tests seem to prove that a gas pack is preferred to vacuum because true displacement of oxygen can be so much or more thoroughly achieved, and, what is more, color of nuts is brighter. There is a tremendous field in films and various laminations.

Reports of Committees

Committee on problems in manufacture of peanut butter:

(The committee on "Problems in Utilization Affected by Quality of Peanuts" joined with this committee.)

C. M. Cruikshank, Chairman
T. E. Bourne
C. H. Willenborg
A. F. Sanchez
C. L. Halladay
G. W. Morrow
J. J. O'Connor
T. H. Hopper
R. K. Willich
F. G. Dollear
H. G. Ray
John Geiger

Report:

1. Economic Importance

Peanut butter manufacturers in 1952 used 273,000,000 pounds of peanuts from a total edible usage of 553,000,000 pounds or a little over 50% of the total.

2. Present Situation

Per capita consumption of peanut butter is less than one half of what it was ten years ago. It was generally agreed that the cost of peanuts going into peanut butter is the primary cause of this.

A factor in the cost of finished peanuts, ready for grinding into peanut butter, is the quality of the peanuts. The undesirable factors in these peanuts on which improvement could be made by research are:

a. Damage
b. Shrivels
c. Moisture content

3. The Problem

We suggest that research be carried out which will lead to the development of strains of peanuts and growing and harvesting procedures which will result in a minimum of damaged peanuts and shrivels and with an improved flavor.

We recommend that research be done and factual data be assembled which will determine the minimum standards of quality as to moisture, damage and sizing necessary to make top quality end products.

We would like to see research done toward the end of increasing the value of peanut by-products, with particular emphasis on the use of peanut kernels not desirable for use in peanut butter or for salting or in confections.

Committee on problems in manufacture of salted peanuts, etc.

George Gershuny, Chairman	N. H. Volle
Anthony F. Bologna	C. H. Willenborg (part of session)
W. H. Giles	Gus Elmer, Jr.
J. Green	S. B. Parker, Jr. (part of session)
C. E. Johnson	A. F. Freeman
Joseph J. Moder	N. J. Morris (part of session)
	L. D. Seay

Report:

The meeting considered problems in the manufacture of salted peanuts along the same general outline as used by Mr. Cruikshank, Chairman of the group which discussed problems in the manufacture of peanut butter. The committee discussed the need of research in this field on the basis of answers to questions obtained in a survey conducted by the Peanut and Nut Salters Association in August 1952. This Association comprises nut salters who process about 90% of the dollar volume of salted peanuts.

Economic Importance

Approximately 150,000,000 pounds of peanuts, consisting of both the Virginia and Spanish type, are salted annually. Also, about 110,000,000 pounds go into confections annually. The estimated dollar value to the farmer of both these categories is about $55,000,000 and the products have an estimated total retail value of approximately $150,000,000. At the present time no organized program of research is being conducted on an industry-wide basis or by any governmental agency, specifically on problems in the manufacture of salted peanuts and peanut confections. Improvement in the quality of salted peanuts and peanut confections would increase the consumption of these products.

The committee recommends that research be conducted on the following three problems in the order of priority as given:

1. Blanching
2. Deep-fat Frying
3. Quality of Raw Peanuts

1. Blanching: The following questions arise about the blanching of peanuts in the manufacture of salted peanuts and candy. Answers to these questions through research should result in better quality products.

How should peanuts be pre-roasted to achieve optimum blanching? What equipment is best for pre-roasting prior to blanching? At what temperature and for what period of time should peanuts be pre-roasted to obtain maximum or optimum blanching? Should the peanuts be conditioned in any manner before the pre-roasting operation? What is the effect of storage of peanuts on the dry-roasting operation? Equipment plays an important part in the pre-roasting process. Can research come up with any ideas about possible new equipment, or new types of equipment for this operation?

What is the best method of blanching -- with abrasive rolls, rubber rolls, or with water? From a quality standpoint the industry desires a product which is free of skins and split peanuts, and which will not produce foaming during the deep-fat-frying operation. Will proper blanching extend the shelf-life of the product? What effect does blanching have on the appearance of the finished product?

2. Deep-fat Frying: It was considered that research should be conducted on the following problems: - Overcome objectionable foaming and loss of oil during deep-fat frying of peanuts. Investigate the length of service of cooking oils, including requirement and time of filtration, and type of filter aid. Determine the best type of oil from the standpoint of greatest shelf-life of the product. Investigate the value of antioxidants and best methods of application for improvement of shelf-life of the product. At what temperature and for how long should peanuts be deep-fat fried to produce the best product?

In connection with deep-fat frying the appearance of the product is a very important problem, inasmuch as the sale of the product depends largely on its appearance. This aspect of the product can very often make or lose the sale. Specifically, the committee felt that research should be conducted on the following aspects: How can attractive appearance be produced on peanuts which will remain during its shelf-life? What type of packaging will retain the attractive appearance and flavor of the peanuts? What is the effect of packaging deep-fat fried peanuts under reduced pressure or inert gases?

3. Quality of Raw Peanuts: The committee realizes the importance of having high quality peanuts for the manufacture of salted peanuts and candy. The following difficulties have been experienced with raw peanuts: - (a) Excessive moisture, in which the question of artificial drying and peanuts of more uniform moisture content would be important considerations; (b) excessive damage, which includes both concealed and visible damage. Various questions were discussed under this heading, including: - How does quality affect ease of removal of the skin? How does the maturity of the peanut affect the processing of the peanuts?

These, gentlemen, are the problems with which the salting and confectionery industry are confronted, and if this laboratory can help us out we will be extremely grateful.

Comments of Dr. K. T. Farrell, Quartermaster Food and Container Institute, on the requirements of the Armed Forces for salted peanuts and confections containing peanuts:

I would like to emphasize one subject which I touched upon in my talk yesterday that needs a great deal of research. The Armed Forces, and I are sure a major part of the Confectionery Industry, is interested in obtaining a satisfactory coating for peanuts that will inhibit or prevent moisture and air from entering into the peanut especially when peanuts are components

of confectionery items. We have been working for the past year or so on a zein coating which may prove to be a satisfactory solution. It not only acts as a moisture and air inhibitor but also as an insect repellent to roasted peanuts stored in open containers. We do not know what the ultimate effect of this zein coating will be when the coated peanuts are incorporated in candy but preliminary studies indicate a favorable trend.

We want peanut confections in the rations because of their high popularity, but we are not able to recommend them until such time as their stability has been increased to meet at least our minimum requirements.

Committee on possible contributions of basic research on peanuts:

A. M. Altschul, Chairman
F. L. Avera, Co-chairman (Mr. Avera presented the report)
L. C. Brown
Ben M. Birdsong
Victor R. Boswell
Kenneth T. Farrell
C. B. Gilliland
William K. Kuehn
R. T. O'Connor
T. A. Pickett
Irwin F. Reed, Sr.
Chas. E. Sando
J. D. Sargent
Will H. Shearon, Jr.
L. H. Turner
Henry S. Ward, Jr.
N. J. Morris (part of session)

Report:

We feel that fundamental research projects must relate (1) to the practicality of available funds, and (2) to the importance of each project with regard to all levels of the industry from the consumer right down to the processor, sheller, and the farmer. Our recommendations are, we feel, predicated on an importance to the entire industry.

The committee recommends research on the following five problems in the order of priority as given:

1. Curing
2. Better Varieties
3. Peanut Hulls
4. Role of Metals in Peanuts
5. Effect of Heat on Nutritive Value of Peanut Products

1. Curing: - Curing is important to every segment of the peanut industry. Development of rapid methods of curing could change the economics of the peanut industry. A rapid method of curing by making possible mechanized harvesting procedures would save the farmer 30 to 60 dollars a ton. Better curing would result in products of better quality. Better curing may allow peanuts to flow more readily into the oilseed field. The research which is needed is fundamental research on the effect of heat + rate of moisture loss on peanut quality.

2. **Better Varieties:** There is a need for research on production of better varieties. Varieties that will be more productive, more uniform, and more resistant to disease can be produced, handled and processed more efficiently and therefore at a lower cost per ton than our present varieties. Higher uniformity, improved flavor, appearance, and resistance to injury by disease or other unfavorable conditions are all needed for improvement of market and eating quality of peanuts for food. Certain varieties may be particularly suitable for production of oil and meal. The research which is needed is in breeding to produce strains of greater uniformity, better quality, and increased yield.

3. Peanut Hulls: The present methods of disposing of approximately 150,000 tons of hulls available this year from shellers represents a loss in economic possibility.

A better use which would return more for the hulls might well appreciably affect the cost level of the peanut itself and contribute to a better economic picture. It could perhaps even result in as much saving as 1/2¢ a pound in the cost of peanuts, if the distribution of hulls as a byproduct could be developed. The problem is to find an end use for peanut hulls.

4. Role of Metals in Peanuts: This is important for all levels of the industry, in that it might reduce damage and increase dollar value in terms of quality. The problem revolves around the necessity to determine the importance of metal contents in the keeping quality of peanut products.

5. Effect of Heat on Nutritive Value of Peanut Products: There is no recommendation for specific research on this subject at the moment. It would be desirable to make a survey into the known facts about nutrition to ascertain what has been and is being done on peanuts, and what is known about the relationship of heat to the nutritional value of peanut products.

Open Discussion, General Comments, and Announcements

Following the committee reports, Mr. Gershuny opened a discussion on means for developing closer relationship between industry and research. He recommended the appointment of an informal industrial committee to work with the Laboratory by correspondence, telephone and meeting, when necessary, for the purpose of helping to formulate research which would be of greatest value to the entire Peanut Industry. After some general discussion, Dr. Altschul phrased the following resolution:

"It is recommended that every trade association dealing with peanuts in one form or another be invited to appoint a research committee to maintain contact with the research workers at the Southern Regional Research Laboratory, at the State Experiment Stations, and Federal government in Beltsville to help them plan their research program and evaluate it".

A copy of this resolution should be sent to every Association on behalf of those in attendance.

Mr. Gershuny moved and Mr. Brown seconded adoption of this resolution and it was unanimously adopted. A member of each of the research committees would then be combined into one overall research committee for the entire industry.

Mr. Gershuny expressed the thanks of his association and his industrial colleagues for the excellent arrangements made for this meeting and the spirit in which it was conducted.

Dr. Altschul replied for the Laboratory and thanked the participants for their excellent cooperation in making the deliberations so successful. He then turned the meeting back to the general chairman, A. F. Freeman, and congratulated him on the success of the meeting for which he was in a large measure personally responsible.

Mr. Freeman announced that proceedings will be sent to all in attendance and thanked the members of the staff who assisted in planning and conducting the conference.

The meeting was adjourned.

PROGRAM

February 5, 1953 - 9:30 a.m.
Conference Room - SRRL

Chairman, T. H. Hopper, Head
Analytical, Physical-Chemical and
Physics Division, SRRL

Address of Welcome - C. H. Fisher, Director, SRRL, BAIC, ARA, USDA

Some thoughts concerning basic research on peanuts --
George W. Irving, Jr., Assistant Chief, Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D.C. (presented by Dr. C. E. Sando).

Research on production of peanuts for food --
Victor R. Boswell, Head, Division of Vegetable Crops and Diseases Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland.

Research at Southern Regional Research Laboratory on utilization of edible peanuts --
Andrew F. Freeman, Oilseed Division, SRRL, BAIC, ARA, USDA, New Orleans, Louisiana

Luncheon - 12:30 p.m. Lenfant's Restaurant

February 5, 1953 - 2:00 p.m.
Conference Room, SRRL

Chairman, T. H. Hopper, SRRL

Need of the Armed Forces for Peanut Products
K. T. Farrell, Chief, General Products Division, Food Laboratories, Quartermaster Food and Container Institute of the Armed Forces, Chicago, Illinois

Role of composition in utilization of peanuts for edible purposes --
C. L. Hoffpauir, Analytical, Physical-Chemical and Physical Division SRRL, BAIC, ARA, USDA, New Orleans, Louisiana

Utilization problems in the peanut butter industry which might be resolved by research --
William K. Kuehn, President, Good Foods, Inc., Minneapolis, Minn.

Addendum to presentation of William K. Kuehn on utilization problems in the peanut butter industry --
F. L. Avera, Director of Research, Rosefield Packing Company, Alameda, California

Problems in utilization of edible peanuts in the peanut-salting and confectionery industries --
C. E. Johnson, Vice-President, The Kelling Nut Company, Chicago, Illinois

4:00 p.m. -- Tour of SRRL

February 6, 1953 - 9:30 a.m. Committee Meetings
SRRL

Room 2002 - Problems in manufacture of peanut butter --
Chairman, C. M. Cruikshank

Room 3022 - Problems in manufacture of salted peanuts and confections containing peanuts --
Chairman - George Gershuny, President, Peanut and Nut Salters Association, Newark, New Jersey

Conference Room - Possible contributions of basic research on peanuts --
Chairman, A. M. Altschul, Head, Oilseed Division, SRRL, BAIC, ARA, USDA

Luncheon - 12:30 p.m. Beach House

February 6, 1953 - 2:00 p.m. Chairman, A. M. Altschul, Head,
Conference Room, SRRL Oilseed Division, SRRL

Report - C. M. Cruikshank, Chairman, Committee
Problems in manufacture of Peanut Butter

Report - George Gershuny, Chairman, Committee,
Problems in manufacture of Salted Peanuts and Confections Containing Peanuts

Comments - K. T. Farrell, QM Food and Container Institute
Requirements of Armed Forces for salted peanuts and candy containing peanuts.

Report - F. L. Avera, Co-chairman, Committee,
Possible contributions of basic research on peanuts.

Recommendation and discussion of establishment of industrial advisory committee on peanut research.

Open discussion, general comments, and announcements

Adjournment

LIST OF ATTENDANCE

Avera, F. L. Rosefield Packing Co., Alemeda, Calif.
Birdsong, Ben M., Birdsong Storage Co., Inc., Suffolk, Va.
Bologna, Anthony F., Chief Chemist, Chas. Dennery, Inc., 524 Magazine Street, New Orleans, La.
Boswell, Victor R., Head, Div. of Fruit & Veg. Crops & Diseases, BPISAE, USDA, Plant Industry Station, Beltsville, Md.
Bourne, T. Earle, Schindler's Peanut Products, Inc., 914-11th Street S.E., Washington, D.C.
Brown, L. C., Swift & Co., Union Stock Yards, Chicago, Ill.
Cruikshank, C. M., Executive Vice-Pres., Cinderella Foods, Dawson, Ga.
Elmer, Gus, Jr., Asst. Prod. Mgr., Elmer Candy Co., Inc., 540 Magazine St., New Orleans, La.
Farrell, Kenneth T., Chief, General Products Div., Food Labs.,QM Food & Container Institute, Chicago, Ill.
Geiger, John B., Gen. Supt., Blue Plate Foods, New Orleans, La.
Gershuny, George, Newark Packing Co., Newark, N.J.
Giles, W. H., ElectriCooker Div., General Foods Corp., 11th & Hudson Streets, Hoboken, N.J.
Gilliland, C. B., Fats & Oils Branch, PMA, USDA, Washington, D.C.
Ginaven, M. E., Vice-Pres., Machinery Sales, The Bauer Bros. Co., Springfield, Ohio
Green, J., Project Leader, Process & Product Development, General Foods Corp., 11th & Hudson Streets, Hoboken, N.J.
Halladay, C. L., Asst. Mgr., Derby Foods, Inc., 3327 W. 47th Place, Chicago, Ill.
Johnson, C. E., Vice-Pres., The Kelling Nut Co., 2800 W. Belmont Street, Chicago, Ill.
Kuehn, Wm. K., Pres., Good Foods, Inc., 5725 Highway 7, Minneapolis, Minn.
Moder, Joseph J., Jr., Associate Professor, Ga. Tech., Atlanta, Ga.
Morrow, G. W., Manager, Greenwood Products Co., Greenville, Fla.
O'Connor, John J., Geo. Hogue Co., 1600-2-4 St. Louis Ave., Kansas City, Mo.
Parker, S.B., Exec. Vice Pres., Electric Sorting Machine Co., 410-44th Street, S. W., Grand Rapids, Mich.
Pickett, T. A., Assoc. Chemist, Ga. Expt. Sta., Experiment, Ga.
Ray, Homer G., Jr., Georgia Peanut Co., Moultrie, Ga.
Reed, Irvin F., Sr. Agri. Engr., USDA Tillage Machinery Lab., Auburn, Ala.
Sanchez, A. F., Vice-Pres., Blue Plate Foods, Inc., New Orleans, La.
Sando, C. E., Technical Advisor, Bur.of Agri. & Ind. Chem., USDA, Washington, D. C.
Sargent, J.D., Pres., Southwestern Peanut Growers Assn., Gorman, Texas
Seay, L.D., Marianna Peanut Co., Marianna, Fla.
Shearon, Will H., Jr., Associate Editor, American Chemical Society, Houston, Texas.
Turner, L.H., Vice-Pres., Southeastern Peanut Assn., Tifton Seed Shellers, Inc., 111 9th St., Tifton, Ga.
Volle, N.H., The Kroger Co., 1212 State Ave., Cincinnati, Ohio.
Ward, Henry S., Jr., Associate Botanist, Alabama Polytechnic Inst., Auburn, Ala.
Willenborg, Carl H., Sales Engineer, Jabez Burns & Sons, Inc., 11th Ave. & 43rd St., New York 36, N.Y.

SUMMARY

(Note: This summary of the conference was furnished on February 27, 1953 to trade and technical journals serving the peanut industry.)

Nine specific recommendations for research on peanuts were adopted at the peanut conference on utilization for edible purposes, held in New Orleans, La., February 5-6, 1953, at the Southern Regional Research Laboratory of the USDA Bureau of Agricultural and Industrial Chemistry. Improvement in quality of raw material was stressed repeatedly as the most important problem confronting the different segments of the industry. These research recommendations may be divided into three classes, as follows:

Peanut butter industry. Two factors regarding the quality of peanuts on which improvement could be made by research were amounts of damaged and shriveled peanuts, and the variation in moisture content of raw stock available to the industry. These problems should be attacked by research on production and harvesting of peanuts, which will diminish these difficulties and will result in improved flavor, and by research on improved utilization of byproducts, particularly on uses for peanut kernels undesirable for use in edible peanut products.

Nut salting industry. Emphasis in research should be placed on improving the quality of products by development of better techniques in blanching and deep-fat frying operations, and on improving the quality of the raw peanuts to be used by this industry.

Over-all industry problems. Research is needed: To increase the use of peanuts as an oilseed; on production of peanuts of high quality and yield; on development of uses for peanut hulls; and to determine the importance of trace metal content in the keeping quality of peanuts. A survey should be made of existing information on the relation of heat treatment during processing and nutritional value of peanut products.

These recommendations were formulated by three committees whose subjects and chairmen were as follows: Problems in the Manufacture of Peanut Butter, chairman - C. M. Cruikshank, Cinderella Foods, Stevens Industries, Dawson, Ga.; Problems in the Manufacture of Salted Peanuts and Confections Containing Peanuts, chairman - George Gershuny, Peanut and Nut Salters Association, Newark, N. J.; and Possible Contributions of Basic Research on Peanuts, chairman - A. M. Altschul, Southern Regional Research Laboratory, New Orleans, La.

Adopted at the conference was a resolution that the various peanut trade associations appoint committees to confer with the Southern Laboratory and with other agencies conducting research on peanuts.

Brief abstracts of the addresses at the conference are given below.

G. W. Irving, Jr., Bureau of Agricultural and Industrial Chemistry: Brought to attention of conference the growing demand and need for fundamental research, particularly that dealing with chemical composition of crops and other plants. Suggested that the group discuss and consider a program of basic research directed primarily toward better quality and increased nutritional value of raw peanuts and peanut products, with further thought accorded problems relating to peanut oil and meal. While it is impossible to predict in advance how fundamental research will result in increased profits, long-term research will ultimately pay dividends to the peanut industry just as it has aided and will continue to aid other industries.

Victor R. Boswell, Bureau of Plant Industry, Soils, and Agricultural Engineering: Research on peanuts has been so badly neglected that the production of this crop receives far less attention than some other crops having considerably less economic importance. In the main, too little fundamental work is being done on the peanut plant and its management, and emphasis has been placed on the kind of work that promises to turn an immediate profit.

The breeding program should be continued with increasing attention to resistance to specific diseases or disease complexes. For ultimate successful use of varieties developed, industry should initiate the peanut seed supply business for maintenance of high quality seed stocks.

Research to be continued:

Fertilizer and soil management
Deficiencies of minor elements in the soil and plant
Harvesting and curing
Structure and behavior of the peanut plant

A. F. Freeman, Bureau of Agricultural and Industrial Chemistry: Reviewed results of research at Southern Regional Research Laboratory on improvement of quality of peanut butter. He said that investigation has indicated that careful control of roasting conditions is necessary for the production of peanut butter of optimum flavor and good keeping quality; and that the oil in peanut butter satisfactorily resists the onset of rancidity during storage for two years at 80° F. regardless of roasting accorded the peanuts, or incorporation of salt and hydrogenated peanut oil in the product. Information was presented about prevention of oil separation in peanut butter, and about general processing and methods of analysis of peanuts and peanut butter of value to peanut butter manufacturers for controlling the quality of peanut butter and gaging the efficiency of specific operations. A complete review of this investigation will be published.

K. T. Farrell, Quartermaster Corps: Rations in modern warfare must be of high caloric density, capable of increasing battle efficiency, available in quantity, must preserve life, and must be of high quality. Peanut butter

is one of the most valuable foods in that it has all of the desirable characteristics required for rations. Six and one-half million pounds were purchased by the Chicago Quartermaster 12 months ending October, and the same quantity is likely to be purchased in the next 12 months.

Salted peanuts and confections containing peanuts cannot be included yet in rations because of inadequate packaging protection. Also more research is needed on newer antioxidants and methods of application, and on deterioration of the non-oil constituents of peanuts and peanut products.

C. L. Hoffpauir, Bureau of Agricultural and Industrial Chemistry: Reviewed literature in role of composition in utilization of peanuts for edible purposes.

William K. Kuehn, Good Foods, Inc.: Everyone here recognizes the part that intelligent research plays in the quality of any product, but it is not as readily admitted that quality, in turn, plays a very important part in our selling prices. Mr. Kuehn said it must be admitted, however, that selling prices are derived from costs, and he believes that costs can be lowered through the proper research. The peanut butter manufacturer is in a poor position because of the quality of the peanuts he receives for processing.

Research can contribute much in improving the quality of peanut products. Appearance and taste are the most important aspects in the quality of peanut butter. The problem of reduction of specks in peanut butter, or amount of unblanched skin, may be solved by production of raw peanuts of improved quality. A single variety of peanuts is desirable which will embody the flavor characteristics of mixtures of Virginias and Spanish, uniform size for blanching, uniform moisture content to reduce shrinkage, and uniform characteristics to produce even roasting and consequently good taste.

F. L. Avera, Director of Research, Rosefield Packing Company: In an addendum to the address of Mr. Kuehn, he stated that the peanut industry needs three things from research:

1) Knowledge how to cut the farmer's loss in yield and quality.
2) Knowledge how to cut the loss through shrinkage and excess processing cost while peanuts are in the hands of the sheller.
3) Knowledge how to cut the end user's loss through shrinkage, pick-outs, unacceptable flavor, and excessive shelf depreciation.

C. E. Johnson, Vice-President, The Kelling Nut Co.: The past program for improvement of peanut butter dovetails or parallels the needs of the nut-salting and confectionery industries. We just want to learn more. Peanuts are good food, packed full of concentrated food energy (fats, proteins, and vitamins). Possibly artificial drying or curing can be developed without loss of flavor.

There are few secrets in the nut-salting industry. A salter who turns out inferior products can injure all the other good salters. Research provides the means of improving the processing methods of the industry so that everyone from farmer to consumer may be a gainer.

Problems of the nut-salting industry which can be resolved by research are:

1) Excessive amount of split and unblanched peanuts resulting after blanching operation.
2) Excessive foaming and relatively short service and keeping time of cooling oils.
3) Short shelf-life of products resulting from inadequate packaging.